THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. JUNE 8, 1893. CHICAGO, ILL. NUMBER 23.

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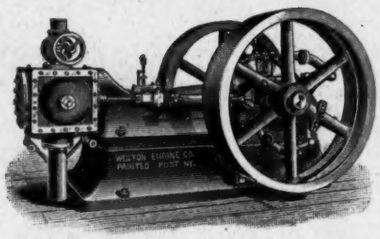

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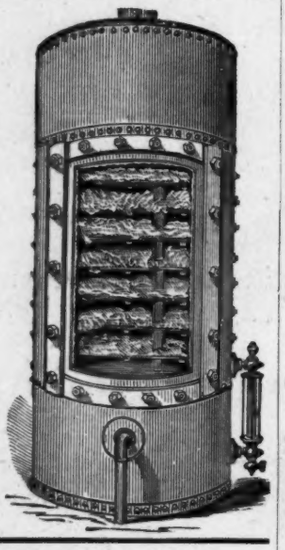

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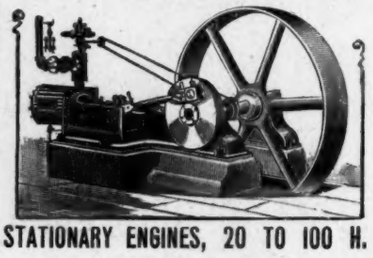

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THE IRON TRADE REVIEW

VOLUME XXVI. CLEVELAND, O. JUNE 8, 1893. CHICAGO, ILL. NUMBER 23.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The financial situation still overshadows everything, and were it not for the fact that July 1 is now the pivotal point in all iron trade calculations there would be little on which to base market talk. The failure of the Grant Locomotive Works with some large material accounts among their debts and the assignment of two Southern pig iron producers, as noted elsewhere, make the past week the most disastrous the iron trade has seen in some time. Daily developments among banking and manufacturing concerns emphasize the danger of going into debt beyond the reach of reasonably quick assets for relief in the hour of difficult borrowing. The enlarging of bank reserves to prepare for any action by timid depositors makes a trying situation for concerns that have counted on a continuance of the large credit available in the easy money market of nine months ago. The liquidations that are a leading feature of every day's news mean profitable business for the fittest who survive, but there is no present consolation in that. The necessity of realizing on their product has led some pig iron producers to make very low cash prices, but such transactions do not establish the market, and at any rate the terms are not available were it desirable to quote them. Pig iron production is likely to be curtailed still more within the month by the blowing out of furnaces that find no profit in the present market. This might add strength to the pig iron market were it not that the mill shut downs will reduce the demand for Bessemer and forge irons. The season's buying of Lake Superior charcoal iron is still postponed by many concerns. Some trading has been done, and at Detroit the demand has been fair; yet season prices have not been fixed, and buyers do not seem to fear a little longer wait. The malleable trade has seen a slight falling off and there are evidences that a good many car orders, about to be placed, have been postponed on account of the closeness of money. At Pittsburg, Bessemer has been quiet, with the price a trifle weaker than at last report. The mills, though in many cases fully supplied with work for June, are getting the lowest prices on record, and the tendency continues downward. On some recent contracts calling for bars, steel has been bought where iron was used last year, the quotation, 1.50c., being the lowest ever made to the buying firm. In structural lines there is a moderate demand, and steel mills have all they can handle temporarily, with the putting in of small orders for June delivery; but heavy contracts are few, and there will be no great loss if July should be a continuous holiday.

THE CLEVELAND OUTLOOK.

Negotiations are practically concluded that will add the largest steel producer in the Western district to the list of ore-buyers. The purchases will include a large block of Norrie at $3 75, the price made to the Carnegie Co. Some small sales of ore have been made in the week at prices conforming to the range heretofore quoted in this column. Transactions of the past 60 days have been practically on the following basis: Republic and Champion No. 1, $4.35@$4.50; Cleveland and Lake Superior No. 1, non-Bessemer, $4; Chapin, $3.65; soft hematites No. 1, non-Bessemer, $3@$3 25; Gogebic, Marquette, Menominee and Mesabi No. 1 Bessemer hematites, $3.65 @$4; Minnesota No. 1 Bessemer, $4.50; Minnesota No. 1 non-Bessemer, $4; Chandler No. 1 Bessemer, $4; Lake Superior and Lake Angeline extra low phosphorus Bessemer, $4.65. The prophecy of ore men that sales late in the season will be rather at an advance from these figures than below them, is based on the steady maintenance of the low rate of shipment, the curtailment of operations at a number of mines, including several important producers, and the bar to the shipment of unsold ore, or to the mining of any considerable quantity of it, in the present state of the money market. It is fair to reckon that monthly payments on ore sold were bringing three times as much money into Cleveland a year ago, as is now being received on ore account. Curtailment goes on steadily at the mines. Of the 24 Gogebic shippers of 1892, only ten have shipped ore thus far. In the Crystal Falls district, on the Menominee, there is a decided cutting down of force. The suspensions at the Dunn and Claire, both Schlesinger properties, are to be followed, it is reported, by curtailments at the Sunday Lake, on the Gogebic, and at the Buffalo group, on the Marquette. In the past two days freights have shown more strength. The Escanaba rate has advance to 70 cents, and on wheat from Duluth 3c. was paid on Tuesday, equivalent to $1.12 on ore from the head of the lake. There is no change as yet in Marquette and Ashland wild rates on ore, but vesselmen's ideas on contract tonnage have appreciated somewhat.

Pig Iron. Valley furnaces are for the most part sold up to July 1, and there has been little iron offered for close delivery. The prospect that the demand for Bessemer pig may fall off through the suspensions of billet mills has prevented the advance from continuing toward the $14 point, as the apparent relation of supply and demand might have warranted. Mill iron is weak; foundry, owing to light operations by most buyers, is still dragging. Two valley furnaces have recently changed from foundry iron to Bessemer.

Finished Iron, etc. The developments in the preliminary conference between finishers and manufacturers indicate that some important changes in the make-up of the scale will be insisted upon and that July, at least, will be an off month. Orders are plentiful in small lots. In old material, prices continue on the down grade. The scrap market is especially weak.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The stringency of the money market in Chicago culminated in a run on several of the strongest banks in the city the first of this week, but with the exception of one private bank, none of them have been obliged to suspend payment. Owing to the unsettled state of affairs all buyers are sailing pretty close into the wind, and are purchasing only enough for their immediate needs. A few inquiries have been received for pig iron in the past week, that will likely lead to sales eventually, but no lots of any large size have as yet been closed. Dealers in finished material report a quiet market.

PIG IRON.—A few sales of Southern coke have been made in the past week, but Northern irons have been very quiet, with sales of only small amounts. Lake Superior charcoal is very quiet, with little or no demand. None of the agricultural implement men have bought any large lots yet, and as their season is several weeks behind this year, it is hardly likely that they will buy largely for several weeks to come. Foundries of other classes are also a little short of business, and one large buyer, who usually uses 1,000 tons a month, has requested his dealers not to rush shipments until further orders. Dealers are not pushing business very hard at present, preferring to wait to see the outcome of the present financial panic. Collections are very slow, and sellers of iron are chary of dealing with any but buyers of undoubted standing.

BAR IRON.—While some of the implement makers have asked for quotations on bars lately, none of them have as yet brought anything. Only a small number of sales were closed in the week, and those not for large amounts. Quotations remain at 1.50c to 1.55c for iron, and 1.70c for steel bars, Chicago.

RAILS AND TRACK SUPPLIES.—No new business has come up in the past week, the railroads only buying for their immediate needs. Prices remain at our last quotations. Rails, $30 to $32; track bolts, 2.65c to 2.70c; spikes, 2.05c to 2.10c.

STRUCTURAL IRON.—No contracts of any size have been let, and only a few small orders have been taken. The quotations are unchanged. Beams and channels, 1.95c to 2.10c; plates and angles, 1.95c to 2.10c; tees, 2.25c to 2.40c.

SHEETS.—A moderate business has been done in black sheets, with unchanged prices—2.85c to 2.90c. Galvanized sheets are selling fairly well from store, and a few good mill orders have been received. Quotations are 70 and 10 to 70 and 7½ per cent. at the mills, and 70 per cent. from store.

PLATES, TUBES, ETC.—Business has been rather dull, the only buying done being for immediate requirements. Tank plates, 1.85c to 2c; shell steel, 2.15c to 2.25c; fire box steel, 3.75c to 4c; flange steel, 2 40c to 2.50c. Tubes, discount 65 to 67½ per cent.

MERCHANT STEEL.—A fair run of small orders has been received, but no sales of any consequence have been made. Prices are as last quoted. Open-hearth spring, 2.35c to 2.40c; tire, 2c to 2.15c; machinery, 2.20c to 2.35c; crucible spring, 3.60c; machinery, 4.75c; tool steel, 6½c and upwards.

OLD RAILS AND WHEELS.—No business of any size has been transacted, and the market is dull at our last quotations. Rails, $17.50 to $18; wheels, $14.50 to $14 75; steel rails $11 to $14.50, according to length.

SCRAP.—The market is almost dead, and little business has been done. No. 1 forge, $15; No. 1 mill, $11; turnings, $8; mixed steel, $9; coil steel, $13; leaf steel, $14; low tires, $13.

GENERAL MARKET RESUME.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The market has been flat for the past 10 days and the week just ended is one of the dullest the iron trade has seen in a long time. A few sales for prompt delivery have been made but these are confined mostly to Bessemer pig iron and steel billets. There are indications that the shut-down after July 1, may last for some time and buyers of finished material are making arrangements that will carry them through July and August. Prices on Bessemer iron show about the range of last week; in a few transactions, the basis is slightly lower. The market to-day may be quoted at $13.45 @ $13.65. The probability that Bessemer consumption will fall off in July with the stoppage of steel plants is a factor of weakness. Steel billets have been sold on a basis of $22 maker's mill, and that is fairly the market. The possibilities of the scale conferences are a topic of general discussion and there is no effort anywhere to push negotiations that extend many weeks into the future. Muck bar, which has been for some time one of the weakest spots in the market, is now quoted at $23.75 @ $24. Forge iron continues weak, and while Pittsburg sellers generally maintain that $12.25 is the minimum there have been plenty of transactions nearer $12, Pittsburg. There are predictions of lower prices in all products, due to the pressure to sell that results from the financial stringency.

Cincinnati. The iron market has been exceedingly quiet in all branches the past week. The general tendency is to run stocks on hand down to the lowest possible margin. In many lines of melting, consumption has fallen off materially, owing to the stringency in money. Naturally, under these circumstances, there is some shading of prices when a good cash buyer comes into the market. Shipments are going forward quite heavily on old orders, although there is some holding up of deliveries on contracts. Prospects favor a very quiet market for several weeks to come, and it is not improbable that a good many furnaces will blow out in the leading producing districts, North and South. Iron masters generally feel that there is no prospect of a favorable change until money matters become more settled.

Buffalo. Orders are light with prices unchanged. Prospects for the early future not good. The money situation seems to overshadow the market. Cash buyers are in some instances able to pick up good bargains.

St. Louis. The demand for iron during the past week has been very limited. While the foundries in general are running as usual, their consumption is small, and the majority of them are only buying for present needs, and in small lots and early deliveries. The money stringency is responsible for this dull state of affairs, but we believe that this cloud will soon blow over, and then the larger buyers will come into the market and place their orders for large lots.

Louisville. Buying still continues from hand-to-mouth, with no indications of any early change from this policy, which has been a general one for several months. There are always exceptions, of course, and here and there are found buyers who are disposed to place round contracts for extended deliveries at present low figures. There is no change in quotations, but the concessions from $8, Birmingham, for gray forge are not difficult to get, owing to the necessity to realize, in the case of weaker furnaces.

THE IRON TRADE REVIEW

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IRON ORE, IRON AND STEEL MANUFACTURE, MACHINERY TRANSPORTATION, INDUSTRIAL PROGRESS, STATISTICAL INFORMATION, ETC.

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JUNE 8, 1893.

RAILROADS AND THE IRON MARKET.

With iron prices dragging at the bottom and at intervals going through it, as they have been doing the past year, the relation of the carrier to the situation has been more than ordinarily a live question. The competition between Northern and Southern producers of pig iron for markets naturally tributary to the former, but possessed to a certain extent by the latter, has kept the question of pig iron freights in a state of intermittent agitation for several years; and recently a new phase of it, developed in the advance made by Pennsylvania lines on pig iron from points south of the Potomac, has called forth some sharp discussion. Then, too, the question of rail freights on iron ore has been gone over in its various bearings whenever the ore market had an untoward aspect. The conditions this season being peculiarly unfavorable to the ore producer, it is natural that we should find it suggested here and there that the railroads connecting Lake Superior mines with upper lake docks should reduce their charge for hauling.

Two questions are thus raised: 1. Are the Eastern railroads defensible in advancing the rate on Southern pig iron? 2. Does the present condition of the ore market make it incumbent upon Lake Superior railroads to lower ore freights?

As to the first question: While the Southern press has shown no little feeling in its criticism of the railroads, the action of the latter is in practical accord with the principle that has governed Southern roads in their treatment of Southern shippers. Southern roads want all the business they can get, and they have found it profitable to make exceptionally low rates to Southern pig iron producers, that the latter may continue to make and to market the largest possible tonnage. The interest of the Northern road, on the other hand, is to have the largest possible shipment to and from the furnaces contributing to its traffic in the ore, coke and limestone they require and the pig iron they ship. And when the territory disputed is nearer to the Northern furnace, and the Southern road has for a long time made an abnormally low rate that the remote Southern furnace might invade this territory, the action of the Northern road, in putting up the bars, aside from being entirely justifiable on the score of self interest, might even be viewed as the righting of a wrong. There is no sentiment in the matter, however. The roads making the recent advance no doubt satisfied themselves that the competition of Southern iron carried by Southern lines at a 4 mill rate was about to close down certain Pennsylvania furnaces and cut off a source of large freight. So there is little use and less occasion to cry "outrage," "illegal conspiracy" and "violation of the Interstate Commerce law," as one of our Southern contemporaries is moved to do. If there is anything in the freight arrangements on Southern pig iron that collides with the Interstate act, we fancy it is rather to be found in a 4-mill rate on pig iron bound for certain Northern markets—the iron being carried over three or four roads, none of which makes any approximation to that rate on traffic originating on its line and entirely carried by itself.

We are disappointed that the champions of the Southern iron industry, who have so vigorously and persistently urged that the South stop going to seed on pig iron, do not hail this move of the Eastern roads as a blessing in disguise. They should regard it as the imperative call to the long-neglected duty of turning Southern pig iron into manufactured material in Southern mills. Isn't it quite time that the South demonstrated its ability to do something more than mix the materials that Nature put so handily side by side in her hills?

To come back to the second question—a word about Lake Superior railroad freights on ore. The policy of carriers in dealing with large shippers, as illustrated by Northern and Southern lines in their pig iron schedules, is to make all possible concessions to shippers to keep the latter's product moving, when competition threatens to stop production. There is no parallel to this condition, in the case of Lake Superior ore producers. They are not threatened with competition from other home districts. But it is urged that the shipper's interest and the carrier's are to an extent the same and that the carrier should accommodate its charge to the condition of the industry which furnishes it traffic. To this the Lake Superior railroads make answer, that while they might feel called upon to make concessions that would benefit the mining companies furnishing them this large traffic, they do not regard it incumbent upon them to make reductions which would immediately be handed over to a third party—the buyer of ore. They argue that the price of the rail haul and the lake haul are factors in the cost of ore, known to every furnaceman, and the latter would simply make a reduction in freights an occasion for asking further concessions in ore prices. The further point is made, that the tonnage this season will be lighter than for several years and the cost to the roads per ton of freight carried, greater. The 10 cents per ton advance made by roads carrying ore from lower lake ports to furnaces is another factor in the case. The upper lake carriers do not find themselves called upon to make a reduction that would simply balance this, and enable ore-buyers to stand it with greater equanimity. Yet another fact that does not facilitate a freight reduction which would ultimately go to the steel maker, is the constantly widening gap between the cost of Bessemer pig and the price of rails. It would be a little more than human for railroads to assist in reducing the rail-maker's costs, while the latter exacts from railroads practically the same price for rails as when Bessemer brought $3 more.

The question is not so much what the railroads ought to do in a time of demoralization in bearing their share of the decline, as what competition urges them to do. Self-interest, immediate or remote, is the moving argu-

ment in freight concessions. If a reduction will not secure new business or enable the shipper to keep up a volume threatened with curtailment, the railroad is not likely to cut its rates as a matter of pure philanthropy. And while it is easy to suggest what ought to be done to help this or that interest, it is to be remembered that railroads are like ore producers and pig iron makers and rail manufacturers, in making such reductions as competi ion compels or the maintenance of the volume of business suggests.

WARRANT YARDS AT HOME AND ABROAD.

The differences between the methods of the pig iron storage warrant companies of the United States and of Scotland are brought out in a correspondence started some time ago by Mr. James M. Swank. The information is contained in letters written by Geo. H. Hull, president of the American Pig Iron Storage Warrant Co., and Wm. Chamberlain, director of Wm. Connal & Co., Ltd., of Glasgow, Scotland. It is noticeable in this correspond ence, which is just published, that while Mr. Hull goes into details concerning the operations of the warrant sys tem in this country, Mr. Chamberlain vouchsafes only the briefest statement concerning the Scotch system and it requires an explanatory letter from Mr. Hull to Mr. Swank to make this entirely intelligible.

It appears, from a newspaper clipping sent by President Hull's Scotch informant, that the market prices of various brands of pig iron alongside ship at Glasgow, ranged, at the time the report was made, from 42 to 53 shillings for No. 1 and from 41 to 49 shillings for No. 3, and that warrants for 500 tons—300 tons of No. 1 and 200 tons for No. 3 —were selling in some instances at 41s 1d. This is a wide difference. It is explained, however, that the seller has the option to deliver any brand he chooses; consequently, he delivers the cheapest iron he can. We are told, however, that there are also trades in particular brands and that "the prices in such cases are as nearly as possible the same as the maker's."

The Scotch system has such a large element of the "sight unseen" about it, that it partakes peculiarly of the operations of grain and stock pits. The buyer knows that he will get the cheapest iron the seller can furnish, but just how low a grade the latter can get hands on and in what quantity he is not informed. Naturally the cheaper grades accumulate in warrant yards and the low quotations on warrants could only exert a depressing effect upon the general market.

President Hull emphasizes the different practice of the American Pig Iron Storage Warrant Co. in several par ticulars. The warrants issued are for 100 tons instead of 500, and for but one grade of iron, whereas under the Scotch system, with warrants calling for 300 tons of No. 1 and 200 tons of No. 3, the consumer who may want but one grade must take nearly as much of a grade he does not want. As to the price, he says that it varies ac cording to demand. In the active iron market in the United States, in the last three months of 1889, warrants "sold all the way from 50 cents to $2 per ton above the price of the iron they represented. During the last year or two, during which time there has been no speculative demand for warrants, they have had to be sold at from 50 cents to 75 cents per ton below the price of the iron they represented when they were thrown on the market."

As opposed to the tendency of the Scotch system to accumulate the low grades, President Hull says that the aim has been in this country to accumulate the best irons. On regular exchange sales only standard brands, and the most salable grades of these, were listed as deliverable—No. 1 foundry, No. 2 foundry, No. 3 foundry and grey forge, with a difference of 50 cents between each grade and the one following. Irons not regarded as merchantable are only delivered on sales in which they are particularly named. There is the further difference between the American and the Scotch practice, that forge iron is not included in Scotch warrants.

A suggestive commentary on the practical working of the system when it becomes an influential factor in the market, is contained in a single sentence of Director Chamberlain's letter to President Hull: "Speculations in warrants might raise or lower the price considerably from the maker's prices, but as a rule these latter fluctuate in sympathy with the warrants." The American warrant system has no such dominating influence. With 76,000 tons in yard May 20, and 200 tons put in yard in the next 11 days, the total May 31, was 76,700 tons, just 100 tons having been withdrawn in the interval. In general, the tendency has been to an increase of warrant yard stocks, but it has been very gradual and only now and then has iron gone out in volume sufficient to weaken the market.

PRODUCTION OF ANTHRACITE IRON.

From being third and fourth in rank, respectively, among the pig iron producing States, New York fell back to fifth place and New Jersey to tenth place in 1890. Advance sheets just issued by the Superintendent of the Census show that in the decade ending with 1890, New York made a ten per cent. advance in her output of pig iron, while New Jersey's production has fallen off about 8 per cent. in the same time. The total production of iron and steel from 89 New York establishments was 598,300 net tons in 1880; in 1890, from 55 establishments, the output was 593,712 tons. New Jersey produced 243,860 tons of iron and steel in 1880, from 40 establishments; in 1890, from 37 establishments, 303,430 tons.

The blast furnace record is interesting, as showing the number of stacks that have been eliminated from the account in the decade, and the extent to which coke has superseded anthracite coal as a blast furnace fuel. In 1880, New York produced from 57 furnaces, 313,368 net tons of pig iron; in 1890, from 37 furnaces (24 having been abandoned and four built in the decade), 344,399 net tons. New Jersey produced 157,414 tons in 1880, from 20 stacks, and in 1890, 145,040 tons from 18 stacks. In 1880, New York furnaces used 396,864 tons of anthracite coal and 34,237 tons of coke; in 1890, 185,348 tons of anthracite coal and 241,824 tons of coke. New Jersey furnaces used 225,713 tons of anthracite and 17,000 tons of coke in 1880; in 1890, 173,067 tons of anthracite and 37,856 tons of coke—a much less marked change than in New York.

In 1880, a large number of the blast furnaces in New York and New Jersey employed anthracite coal exclusively. Of the 37 furnaces in New York, in 1890, 14 used a mixture of anthracite coal and coke, four used anthracite coal exclusively, four used coke alone, four used charcoal, and the remaining 11 furnaces were idle all the year. Of the 18 blast furnace stacks in New Jersey, in 1890, eight used anthracite coal and coke, four used anthracite coal alone, and six were idle throughout the year.

New York, New Jersey and Pennsylvania are the three States in which pig iron is made with anthracite or with mixed anthracite and coke. In New York there has been a slight increase in the past three years, in the amount of

iron made with fuel wholly or partly anthracite; in New Jersey, a steady decrease; in Pennsylvania, likewise, a decrease. The result has been a steady diminution in the total, as appears in the following statement, which uses the gross ton:

PRODUCTION OF ANTHRACITE AND MIXED ANTHRACITE AND COKE PIG IRON.

	1892.	1891.	1890.
New York	228,206	201,671	189,072
New Jersey	87,975	92,490	129,500
Pennsylvania	1,480,932	1,571,947	1,867,839
Total	1,797,113	1,866,108	2,186,411

IT is telegraphed from Pittsburg that the members of the Amalgamated Association's scale committee who have been at work there on the new wage schedules "take a hopeful view of the trade outlook." If hopeful outlooks by employees could only fill order books at good prices, such statements might not appear so completely ridiculous.

RECEIVED FROM THE TRADE.

Jos. Dixon Crucible Co. send out a unique folder with one of their red hexagon pencils, in lithograph, stretched across the cover. The inner pages recite various uses and grades of Dixon's American Graphite pencils, stress being laid on their adaptability to artists', draughtsmen's and architects' work as well as for office and counting room purposes.

"A Plan of the World's Columbia Exposition and Handy Map of Chicago," which comes to us with the compliments of Henry R. Worthington, New York, exhibits one of the best uses to which we have seen a World's Fair map put. The map of down-town Chicago is a good and useful feature, but the universality of the name Worthington in connection with pumping equipment could scarcely find better recognition than is given it in the red flags which dot the map of the Exposition grounds on the opposite side of the sheet. No less than 22 of these flags are flying, each standing for a Worthington engine or pump, or condenser, or some other product of the Worthington works. Greatest of all is the Worthington group at the pumping station at the east end of the boiler house connected with Machinery Hall. It consists of one horizontal triple expansion engine, one horiztonal high duty engine, two vertical engines, with a combined capacity of 40,000,000 gallons a day; also two fire pumps—all in operation. In the other buildings Worthington pumps, condensers, feed pumps, pressure pumps, etc., are operated in connection with exhibits of various manufacturers of machinery. In a handy pamphlet accompanying this map, a history of the Worthington house is given, with references to the various branch headquarters established all over the world. Illustrations are given of the various types of Worthington pumps and engines, with a graphic putting of the growth of the water works department of the establishment, 343,000,000 standing for the 24 hour capacity of the illstallations made in 1891, the 31st year of this department.

The United States Heater Co.'s last monthly postal traveler has a map of the lower lake region, showing the various railroad lines leading in and out of Detroit, and an invitation to the recipient to stop over on the way to Chicago. Then a plat is given of various Detroit thoroughfares, with the most important buildings designated. A star directs the eye to the block occupied by the United States Heater Co. Views of the river and of two of Detroit's beauty spots are very artistically tucked away on the back of the card.

The Foos Mfg. Co., of Springfield, O., send us a copy of their illustrated catalogue of portable forges, blowers, etc., illustrating the various styles of their Cyclone portable forges, blacksmith's hand blowers, drills, power blowers and exhausters. These specialties are exhibited at the World's Fair in the Machinery Annex, Col. 10 D. E. 51. The Foos Mfg. Co. also issues a World's Fair edition of their annual catalogue, devoting it especially to agricultural machinery. Their agricultural exhibit is prominent in Agricultural Hall, Jackson Park.

The first business card put out by the J. A. Fay & Egan Co., of Cincinnati, gives some idea of the immensity of the combined plants, an engraving on the back showing all buildings and the six streets that bound them. The various medals awarded the wood-working machinery of the original companies are also displayed.

SCALE NEGOTIATIONS UNDER WAY.

The events of the week in connection with the fixing of the mill scale for the coming year, were the conference at Youngstown, June 3, between a committee of the Finisher's Union and various iron manufacturers in the Mahoning and Shenango valleys; the opening of the 18th annual convention of the Amalgamated Association in Pittsburg, and the meeting in Pittsburg of sheet manufacturers to appoint a committee to meet the employees' representatives. The manufacturers attending Saturday's conference at Youngstown were Myron C. Wick, of the Union Iron & Steel Co.; J. L. Bottsford and W. Scott Bonnell, of the Mahoning Valley Iron Co.; L. E. Cochran and Henry Heedy, of Andrews Bros.; W. F. Bonnell, of the Hubbard Iron Co., and John F. Taylor, of Brown, Bonnell & Co. President Carey, Secretary Mundie and 13 others represented the finishers. There were about three hours of discussion, but nothing was accomplished. The prices now paid for special sizes were objected to in particular by the manufacturers. When the scale was originally drafted special sizes were new and orders for them were only a fraction of the call now. With the large volume of special sizes now called for and the aptitude the men have acquired in handling machinery and the much less frequent changes now made than formerly the manufacturers contend that the scale in this regard should be materially reduced. They claim that the rolls are run now so much on what were formerly special sizes and shapes that they are now practically common. No time was named for another meeting. The finishers' committee did not state whether or not it had full power to make changes in the scale.

The first conference between the Amalgamated committee and Pittsburg manufacturers will probably be held on Saturday, June 10. The Association will appoint its committees at once, and enter promptly upon scale work. The Iron and Steel Sheet Manufacturers and the Galvanized Sheet Iron Association, met at Pittsburg, Tuesday. The Tin Plate Manufacturers' Association met on Wednesday. The wage question was considered, and committees appointed to meet the workers.

At Pittsburg, Saturday, a nolle prosequi was entered by the prosecutor in the cases against the Carnegie Co. officials, growing out of the Homestead riots. The workmen against whom charges are pending were released on their own recognizance.

Some Good Records by Ore Carriers.

The Grecian, of the Menominee line, made the trip from Ashtabula to Escanaba and return, last week, in four days and ten hours, spending 13 hours of this time in loading 2,800 tons of ore. The Grecian has gained a trip on some of the liners that started from Escanaba with her at the opening. The performance noted above has been outdone within a few days, however, by the Roman, of the same line. She went from Erie to Escanaba light, spent ten hours loading, and carried to Ashtabula 2,800 gross tons, all in exactly four days, doing 40 miles more than boats starting from Ashtabula.

The cargo taken out of Ashland by the Yuma on a recent trip broke the record of the Wisconsin Central docks. She had on board 2,954 tons of ore. This was the Yuma's second trip. On the first she took 3,180 tons of grain from Duluth.

The steamer Maryland made a good record last week. Arriving Monday morning at Fairport, O., from Escanaba, she unloaded 3,088 gross tons of Norrie ore and got away the same evening. She reached Fairport on her next trip on Saturday morning, and left the same evening, after discharging a similar cargo, having placed 6,177 tons of ore on the dock in a single week—said to be the largest showing ever made in the same length of time by any lake steamer.

The steamer E. C. Pope took out 2,642 gross tons of iron ore from Marquette, June 1st, breaking the record for ore cargoes from that port.

INTERESTING DISCUSSION ON STEEL.

In connection with the paper of Dr. John W. Langley, of Case School of Applied Science, read at a recent meeting of the Civil Engineers' Club, a discussion took place, which we are now able to lay before our readers. The subject of the paper was, "Some Physical Properties of Steel as Related to Its Composition and Structure." In the discussion a number of interesting points were brought out. Mr. Ritchie opened by referring to Dr. Langley's statement that phosphorus was one of the bad elements in tool steel. He asked whether basic steel was best for tool steel. "That has the least phosphorus, hasn't it?" he asked of Prof. Langley.

Dr. Langley—Yes, and no. It has not less phosphorus than the very best brands of Swedish iron, or the best American brands of iron, such as are very carefully manufactured by the old processes. It has less phosphorus than any of the cheaper grades of structural steel. It is not the best tool steel. We know that all steel which has been melted tends to take up gases, and the complete elimination of these gases, after they have been dissolved, is impossible. Exactly what these gases are I do not know. We know that all steel contains nitrogen, and all contains hydrogen and a small quantity of oxygen. It may analyze as well as the best steel; basic stock does not make the best tools. It is considered good for structural purposes, however.

Mr. Hermann—I would like to ask a question which is probably somewhat foreign to the subject under discussion. It relates to burnt steel. What is "burnt steel," and what is the cause of it?

Dr. Langley—There have been a great many theories on the subject. For a long time it was thought that burning of steel was due to the reception of oxygen from the air, and that it contained oxide of iron. But chemical analysis has failed to show oxide of iron. It has been shown that it can be burnt in a vacuum, as well as in a fire where air is present. "Burning" is throwing carbon out of solution by too long or too high heat, when it is nearly impossible to get it back again. If a piece of burnt steel is heated to the recalescent temperature where the yellow begins to invade the red, and it is thoroughly worked by the hammer, it can be brought back again into the active state; but you can never again get it all quite as good as if it had not been burned. Working at the yellow-red heat is the only remedy for burning.

A Visitor—We have very large thin dies. The matter of hardening is one of great importance for the dies are extremely expensive. Is the heat uniform enough, and will that test be accurate enough for us to apply it to the hardening of dies two feet in diameter and one inch thick. It is very difficult to get them the proper temperature.

Dr. Langley—I doubt whether the test on such a large piece would be accurate enough because a very slight difference in the diameter has a very potent effect upon it. I do not think you can test the whole surface with precision. But on a small mass I think you can. The only way to be safe is to heat them a little above the minimum temperature and let them cool to the right point.

Mr. Barber—It is said that if chilled iron is drawn off in castings, chilled iron will remain in an undissolved condition, and that it forms into globules and is found when the article is put upon the lathe. Is this or is it not, the case?

Dr. Langley—I never had any such experience; never had very much personal experience with foundry work. But the segregation and formation of hard points, is a very common experience. The explanation may be found in this: iron, in order to chill well, must contain only a small amount of silicon, and if some of this iron in the total mixture is charged and then comes down without proper time for mixing it is quite conceivable that the portion which contains a minimum amount of silicon will be harder.

Mr. Barber—In other words, you think chilled iron has not been melted?

Dr. Langley—Yes.

Mr. Hermann—Old stove castings which have been repeatedly exposed to high temperatures give trouble by failing to melt.

Dr. Langley—Most of the carbon has been burned out of them, and when you heat them they behave like iron.

Mr. Hermann—They behave more like wrought iron.

Dr. Langley—Yes.

Mr. Hermann—If the centers for lathes are heated to the ordinary hardening temperature and allowed to cool down to such a red heat that it can just be seen in a dark corner, then by plunging them into water, you can soften the same very much. I would like to know whether Dr. Langley has observed this phenomenon.

Dr. Langley—Yes, you can get it still softer if you put it in ashes. If you take a considerable size you can get it soft if you can just see it. You cannot change the solubility of the carbon; all the latent heat has gone out of it, if it is much below the recalescence temperature. Many members of the club have probably used self-hardening tools. It is the general impression that a self-hardening tool is harder than any other tool. This is a mistake. Self-hardening is due to one element, and that is tungsten. The function of tungsten is to delay the rate of change of the carbon; the phenomen of recalescence is lost in self-hardening steel because the change is so slow. If the tungsten metal is submitted to annealing you can both harden and anneal it nearly as well as you can harden and anneal carbon steel by simply changing the "t" in this equation (illustrating on the chart). If you do not do that the tungsten steel it will crack. Many are under the impression that you cannot soften self-hardening tools. You anneal tungsten steel about three times as long you would common steel, and you get a very nice substance. If you want to put your tools to very heavy duty and they are of pure carbon steel they will soften and stop cutting, because the heat will draw the temper. Tungsten acts simply to delay the rate of change, and you can get a tool nearly to red heat if it has tungsten in it, and it will do its work for a long time before the change takes place. Glue water will dissolve just as much salt as pure water, but it does it more slowly. Tungsten acts to iron much as glue acts to water: it is simply a delay of the change; it does not make it any harder than carbon; it does not make it quite as hard. All practical men know that self-hardening tools are good only where you want to do heavy duty.

The President—I would ask Dr. Langley if annealing structural steel, and keeping it at a high temperature, for some time, has the same injurious effect that it has on finer grades of tool steel—if you keep it on high temperature before you allow it to cool.

Dr. Langley—I have only had a moderate experience with structural steel. I don't think you have to be nearly as careful with it as you do with high carbon steel: it will stand more abuse than high carbon steel. There is so little carbon in it, it will stand very much abuse. Get tool steel down to $\frac{7}{10}$-1 per cent. carbon, and you do not have to take much care of it in the annealing.

The President—Would there be any advantage in keeping it hot?

Dr. Langley—I don't think it would, any more than to release the strains in it.

Mr. Hermann—Some pieces of low carbon steel that were overheated and afterwards annealed, behave more like cast iron. One of them was ruptured at a tensile strain of 91,000 pounds and the other at 99,000 pounds. They ought to have stood 120,000 pounds. The annealing did not correct the overheating.

Dr. Langley—That was one of the characteristics over-annealing. My personal experience has not extended into that subject with structural steel.

Mr. Hermann—I happened to be present when one of the pieces was overheated. I didn't think it would have such an effect; but in submitting the sample afterwards to tensile strain I found that result.

Dr. Langley—I think it would, if it was heated up to 855° C., that is where the yellow begins to pass into white.

Mr. Barber—I believe that molten iron is the only substance in which carbon is soluble. I would ask: to what extent is it soluble? How much carbon will molten iron absorb? And at what temperature does this take place.

Dr. Langley—Molten iron is not the only substance that will do it. Manganese will hold more than iron. The maximum carbon that iron can hold is 5 per cent. Manganese holds 6-7 per cent. and chrome 8-10 per cent. This is at the melting point.

Mr. Warner—I met, not long ago, a manufacturer of galvanized iron; he makes a high grade, and he also makes galvanized steel. I asked him the difference. He said it was all the same. In these days when we have iron and steel so near the common basis I wish Prof. Langley would tell us when the steel ends and the iron begins.

Dr. Langley—That is a conundrum that no man can answer.

Mr. Warner—Our former President, Mr. Service, mentioned an interesting fact in this connection. He said that he had seen the best iron treated chemically so it was all dissolved, leaving nothing but slag. It leads me to think that iron contains impurities which steel does not, and these impurities were necessary from its manufacture. That could all be dissolved, leaving simply slag, so that iron is really impure decarbonized steel. If we thoroughly de-carbonize steel does it leave iron in its pure state?

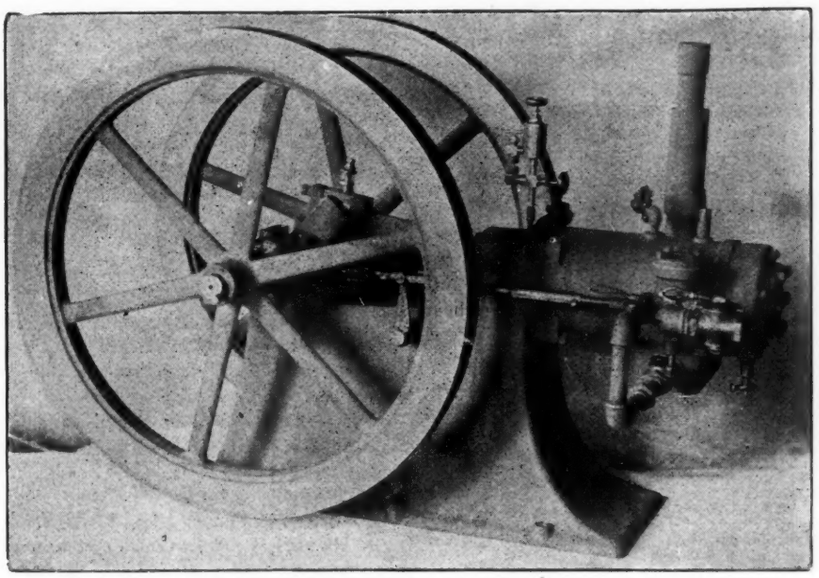
Dr. Langley—The old distinction between iron and steel is: steel is something that will harden if plunged into water. But with Huntsman's discovery of melting blister steel, and with the inventions of Bessemer, we are enabled to melt tons upon tons of cast steel. In regard to the question: where does the line of cast-steel stop, if anywhere—a committee was appointed some years ago to decide what constituted steel. There was one rate of duty on steel and another on iron. There was an international committee appointed also. I think it was decided that any form of iron which had been completely melted and changed into a fluid state and cast into moulds should be called steel, but if it had been made by means of the puddling process it should be called iron. So we can have steel containing less impurity than iron, and yet it would be steel. We can have steel that contains almost no carbon at all, or at least, only a minimum. The other question, as to whether iron is necessarily purer than steel, or not—iron is usually not so pure as steel, because a great deal of slag is retained mechanically. The molecules have been incased in the slag and they are pulled out into cylinders, and it gives iron its fibre. It is mechanically better able to stand a shock. If it is all well worked, iron will stand more abuse than steel on account of mechanical discontinuity.

European Basis Except as to Labor.

An interesting conversation in the presence of the writer recently occured between an American bridge builder and a German engineer now traveling in this country. The peculiarities of American and foreign bridge building were first discussed and then naturally followed the commercial features of the trade. The German engineer stated that bridge builders in Germany paid 1.70 cents per pound or more for steel shapes delivered at their works, hired erectors at 75 cents per day and obtained 3½ cents for erected work. The American bridge builder said that he paid precisely the same price for material and received about the same, or lower, for erected work, but paid erectors three times as much, or $2.25 per day. The comparison thus made shows a remarkable state of affairs and leads to one of two conclusions: either that German bridge builders are doing a very profitable business, or American bridge builders are making no profit whatever. It certainly indicates that we have been making decided progress in getting down to a European basis.—[Iron Age.

THE PIERCE GAS ENGINE.

The horizontal type has been followed in the gas engine recently put upon the market by the Pierce Engine Co., of Racine, Wis. The manufacturers contend that this style of engine gives the best results for stationary uses. The frame and crank shaft bearings are cast in one piece. The cylinder is made separately, and is bolted to the frame. The engine is water-jacketed, as well as the head and exhaust valve. The crank shaft is a solid forging of steel and slotted out, there being no weld in any part of it. The connecting rod has bronze boxes at each end, and can be adjusted to wear without removing piston from cylinder. The fly wheels are extra large and heavy to facilitate smooth and steady motion. The governor is a hit and miss device, simple and sensitive and designed especially for this engine. The piston is of extra length, being the same length as the stroke of engine in all cases; it has snap packing rings, and the pin for rod is of steel, case hardened. The valves, of which there are two, the admission and exhaust, are what is known as puppet or mushroom, and have broad and liberal seats. They will last, barring accidents, the life of the engine.



THE PIERCE GAS ENGINE.

The operation is the usual one in gas engines: On the first out stroke of the piston a mixture of gas and air is drawn into the cylinder through the automatic admission valve at the side of cylinder. On the return stroke of the piston the mixture is compressed and the charge ignited which causes the air to expand and do work. As the piston reaches the end of its stroke the exhaust valve is opened, and the return stroke of piston expels the burnt product of combustion.

The method of ignition is by the electric spark, which it is claimed is more desirable than the hot tube method, and decidedly more economical. When running at full power, the Pierce engine consumes about one gallon of gasoline a day of 10 hours per horse-power. The manufacturers guarantee their engines, which are made in five sizes, to be as economical in fuel as any engine on the market, to be well made, and of the best material obtainable. They will replace any part broken under ordinary usage for one year free of charge.

For the two months from April 3d to June 3d the wages for puddling in South Staffordshire was 7s. 6d. a ton, or $1.82. This is a reduction from 7s. 9d., or $1.88, and with it a corresponding reduction in the wages of mill and forge men. In the north of England the price is 7s., or $1.70, a ton. As in the United States, this amount is divided between the puddler and his helper.

AMONG THE IRON MINES.

Menominee Range:—

The mines at Iron Mountain have been assessed this year as follows: Chapin, $1,300,000; Pewabic, $300,000; Hamilton, $70,000; Ludington, $40,000; Millie, $60,000. Last year the Chapin was assessed at $1,800,000, and the Pewabic at $70,000; the others at the same as this year.

The Chapin company is now sending to the Escanaba and Gladstone docks nearly 7,500 tons of ore every twenty-four hours. Of this amount 3,500 tons is hoisted from the several shafts and the balance is taken from the stock piles. Seven thousand five hundred tons of ore means 375 carloads. Add to this the 2,000 sent out daily from the Pewabic and we have a total of 575 carloads sent to the docks every 24 hours from the Iron Mountain mines.—[Range Tribune, Iron Mountain.

The management of the Sheridan has discharged all the men employed except two, about 40 being thrown out. There are 20,000 tons of ore on stockpile.

There are said to be few more than 100 men now at work in the mines of the Crystal Falls district. At the Dunn the recent curtailment of force was followed last week by the removal of pumps from the bottom levels, and it is expected that a total suspension of operations will come soon. The Dunn cannot be worked at a profit, under a 40-cent royalty, with current prices for ore. At the Claire operations have been curtailed of late. A sale of 10,000 tons is reported.

At the Hamilton the water in shaft No. 1 was tapped with a drill hole, May 31, and in two hours the water in No. 2 had risen 650 feet. Capt. Carbis is thus quoted by the Norway *Current:* "The drift was 313 feet long to the breast, before the last holes were blasted and I think there must be about 12 feet of broken ground between the two drifts. The drift will average 18 feet wide and 12 feet high its entire length, and 140 feet of this was driven in May, with two machines. The water went down in the Ludington shafts at the rate of 15 feet an hour while No. 2 was filling up, and has lowered altogether about 75 feet." The work of bailing will now go on vigorously.

Vermilion Range:—

The Two Harbors shipments for the week ending June 1, were 35,884 tons. For the season to that date the record is as follows: Minnesota grades, 40,150; Chandler, 46,268; total, 86,418. Mesabi range—Silicon, 4,364. Total both ranges, 90,782.

H. V. Winchell is in charge of the Chicago & Minnesota Ore Co.'s explorations on the Mesabi. The company is pushing work to different localities on lands on which a 90-day option was secured from the C. N. Nelson Lumber Co. The Tower *Iron Journal* has the following: "Mr. Winchell recently completed a trip over the Michigan ranges, during which he visited the Norrie, Chapin and other large properties. In contrasting them with the Minnesota, he noted the great difference in equipments and plants generally. Although the Minnesota has the most modern machinery and annually expends a considerable sum in keeping the mine premises in neat shape, the 1890 census mining statistics show that the State of Minnesota ranks first in efficiency of results per man employed. As this census was based wholly on figures taken from Vermillion range mines, the fact is of considerable interest to those who have observed the efforts of the managements, particularly that of the Minnesota, to devote some attention to the general neat appearance about the surface. That the State of Minnesota leads in production per man employed in the mining industry, and that in spite of its hard ores, is no small testimonial to the excellency of the management of our various properties."

Gogebic Range:—

For the week ending May 29, there were only eight shipping mines on the Gogebic. Total for the week sent out from Lake Shore docks at Ashland, 32,661 tons; from the Wisconsin Central, 14,105 tons. The total season shipments from the Lake Shore were 58,372 tons; from the Wisconsin Central, 39,639 tons. Shipments by mines for the season are as follows: Comet, 3,896 tons; East Norrie, 5,857; Eureka, 1,279; Norrie, 16,397; Pabst, 16,397; Sunday Lake, 4,441; Ashland, 9,555; Aurora, 16,197; Colby No. 2, 1,522; Tilden, 8,446; Montreal, 2,886.

At the Comet mine the pumps have been taken up and the boiler fires drawn. When in full operation 80 to 100 men are employed. Indications are that operations will not be resumed this season.

Mesabi Range:—

The men at the Cincinnati and Hale mines went on a strike, last week, on account of the non-receipt of their month's pay. Manager Bates, after a trip to Cleveland, secured the needed funds and work has been resumed.

John B. Weimer claims that the find on section 34, 58-17 is the largest and best on the Mesabi. The lease on this section was recently purchased by Messrs. Kimberly, Weimer and others for $120,000. Mr. Weimer conducted the negotiations. The property was formerly held by Coffin & Warmer, Stryker, Manley & Buck, E. C. Gridley & Co., and others of Duluth.

Marquette Range:—

The Volunteer has made a sale of ore of moderate proportions and at very low price. The Volunteer probably secures its ore for less per ton than any hard ore mine in the region. —[Iron Ore, Ishpeming.

Southern Iron Companies Embarrassed.

The Carnegie Land Co. and the Carnegie Iron Co., of Johnson City, Tenn., made an assignment June 4. The liabilities, due largely to Eastern and Northern parties, are placed at $125,000, and the assets, consisting of a new blast furnace, hotel, lands, town lots, and notes, are estimated at $600,000. Gen. J. T. Wilder, the president, has just returned from the East, where he had been to float bonds to the amount of $100,000, but those who had promised to take them found themselves unable to do so now on account of the prevailing financial stringency, and there was nothing left for the companies to do but to assign. It is confidently expected by the stockholders, most of whom are large Eastern capitalists, that the matter will be straightened out by the middle of October and the companies taken out of the assignee's hands. The property consists of a large new blast furnace, hotel, lands and town lots and secured notes to the amount of over $600,000, while the total indebtedness does not exceed $120,000, much of which is not due.

A newspaper dispatch says that the Appalachian Steel & Iron Co., of Big Stone Gap, Wise Co., Va., has assigned. The capital stock is $450,000 but no statement is given of liabilities and assets. The company have two stacks, Jennie and Polly, each 75x18, with total annual capacity of 60,000 net tons. James F. Peters is president; E. J. Bird, vice-president and general manager; H. C. McDowell, secretary, and W. A. McDowell, treasurer.

THE Grant Locomotive Works, Chicago, made an assignment June 6. On May 1 its liabilities were $410,950.36, and assets $1,151,020.10. The present embarrassment is due to the tying up of a large part of the company's assests in work, which, owing to a strike, it could not get out. The liabilities, outside of a $200,000 mortgage, are chiefly for material. A contract with the C., B. & Q. for 55 engines is under way.

IN 1880, the furnaces of the Western States contributed a little over 26 per cent. of the total quantity of pig iron produced in the country that year, and in 1890 this section made over 27 per cent. of the total output, the small quantity of castings made direct from furnaces, being included in each year.

THE Connellsville *Courier* says that coke operators cannot reduce the price of coke to furnacemen, without reducing the wages of their employes. This they wish to avoid. But coke prices are being cut all the time and even $1.55 has been shaded.

FIRE at the car shop of the Northern Pacific railway, at Brainerd, Minn., destroyed the main building, the cabinet shop, bolt house, two other small buildings and five cars, besides the tools of the workmen. The loss is $25,000.

MACHINE SHOP AND FOUNDRY.

MR. W. J. KEEP ON CUPOLAS.

The following paper by Mr. W. J. Keep, superintendent of the Michigan Stove Works, Detroit, on "Cupolas—Their Construction and Management," was read at the meeting of the National Association of Stove Manufacturers, at Chicago, last week:

Many years ago we measured every cupola of any importance in Troy and Albany, and in many other cities, and learned the shape of the lining when first put in. We procured a record of charges, blast, speed of melting, etc., and tabulated the results, expecting to discover some general correct principles of construction and management, but on the contrary found nothing to show that any shape or kind of management could not be equaled by others. A cupola with a foundry full of piece workers is not a profitable thing to experiment with. If you hear of a melter that can do better than your own, it is better to borrow him for a couple of weeks to remedy your defects, and you can then imitate his management. A few years ago the Michigan Stove Co. hired a melter from Mr. Smyser, to increase the rapidity of their melting, and we have retained the shapes for our cupolas, which we adopted at that time. We shall confine our remarks to cupolas from which the iron is caught by the men who use it, and who carry it away as fast as it is melted.

SIZE.

Small foundries may need a cupola of small capacity, but if there is any chance of the business growing, it is better to have the outside diameter about six feet, and if necessary line it smaller for a few years. A six foot cupola ought to deliver a constant stream without stopping during the heat, that will give a line of men all that they will want to do to take care of the iron. This would fill a 40-pound ladle every six seconds, and would melt from 10 to 11 tons per hour.

As it is diffiult to gauge the stream, it is more general to fill from 75 to 150 ladles in five seconds each, and then stop up for a couple of minutes. The rule should be to give the iron as fast as the men can take it away and return for another dip. The most economical foundry, is one employing enough men to take about 16 tons of iron delivered from a six-foot cupola, in from 1½ hours to 1¾ hours.

SHAPE.

This is not the same for coke as for coal. The tuyeres for coal are often from five to seven inches above the sand bottom, while for coke the distance should be from 14 to 18 inches. It is necessary therefore to determine the fuel before procuring a cupola. Equally good results are obtained with a cupola perfectly straight on the inside, as with other shapes. The rule in blast furnace construction is to allow the lining to burn into any form that it chooses to take, and the next time to line the furnace with the same lines. This is a good rule if we wish to experiment with a cupola at all.

When the bottom is dropped it will be found that the melting point is within two feet of the tuyeres, and that the lining has burned away considerably at that point. The slag will be built out above the tuyeres by the chilling action of the blast. It is customary to chip away this slag and patch the sides. This does little good as the daubing melts off in a few minutes after the blast is on. If only the deepest holes are mended, and the slag is allowed to remain, and is daubed with fire clay, in a few days a bosh will form, and the lining will cease to burn away. If the result is an improvement, the same shape can be retained when the cupola is relined. There will be no trouble about having a clean drop. The melting point is held in the centre so far away from the walls that they are not heated nearly as much as with straight sides.

A four-inch lining above the melting point will last a long time. This gives much more room for iron than a nine-inch lining, and therefore hastens melting. The bosh is above the tuyeres, and if you began with a nine-inch lining, and a straight cupola, and have let the cupola shape itself, you will have worked a bosh in six inches over and beyond the tuyeres, and will have worked the lining above the bosh to 4½ inches thick. The inside diameter above the bosh will be 62 inches. The bosh at the narrowest point is 42 inches, and the diameter below the tuyeres will be 56 inches. The sand bottom will be seven inches thick, and from this to the tuyeres will be about 18 inches. The tuyere opening will be four inches high. From the top of the tuyere for 12 inches the lining will slope inward to the narrowest opening of the bosh. The lining will then gradually expand for 20 inches until a 4½-inch wall is reached.

The heat after leaving the melting point is absorbed by the fuel and iron above it, and the higher the charging door the better.

A charging door on each side is convenient, allowing fuel and scrap to be charged on one side, and iron and sprues on the other. The height of the stack will depend on the neighborhood. A high stack will carry the gases above the surrounding houses. It is difficult to construct a netting that will arrest sparks or that will last. Below the tuyeres, above the bosh, and above the charging doors, flanges should be riveted to the shell, so that any section of the lining can be removed at any time, without disturbing any other part. Bricks costing from $12 to $20 last nearly as well as those costing twice as much, though they are not quite as large.

BLAST AND TUYERES.

Probably the preference would be for a positive blast. It will start off at about 10 ounces, and as the cupola clogs up, will run up to 14 or 15 ounces. An increase of the blast above this will amount to the melting of about one ton additional per hour, for each ounce increased, though some have had a different experience.

The piping from the blower to the cupola should be large with very long curves if any are necessary. The large pipe, say 18 inches diameter, acts as a reservoir, and if long, two cupolas may be driven with one positive blower, which would be expected to drive only one. A large water gauge should be attached to each cupola in such way that the figures can be seen 25 feet away. The one that we use has a reservoir under ground holding 3 gallons, and is made of 3 inch gas pipe with a copper float. It has required no attention for eight years. The wind should enter a bustle at three sides. The bustle should be large, and should extend all around the cupola, and should contain eight or ten large doors easily opened. The tuyeres should be about four inches high and seven inches wide, with at least 16 in a circle, and enough to make a continuous line would be better.

Two or more rows of small tuyeres above this have found advocates, but after use for a short time they are generally abandoned, and as good results are obtained without them.

CHARGES.

The bed of coke must be deep enough to hold the pig iron about a foot above the tuyeres when it begins to melt. Enough fuel must be added at each charge to replenish the bed, and keep the iron at the melting point. There exists various opinions regarding the size of charges. Some use large charges with as good results as others using smaller ones. It would seem, however, that small charges of fuel at short intervals, would replenish the bed more uniformly, and only so much iron can be added, as these additions of fuel will melt. In such a cupola as we have described 1,700 pounds of coke would be used for the bed. About 4,000 pounds of iron would be put on, followed by 300 pounds of coke, which will occupy about five inches in depth. This will melt at least 3,000 pounds of iron, which will occupy about nine inches of depth. Towards the end, as the cupola becomes hot, the coke charge may be decreased slightly. If a large number of charges are to be made, after the 16th, the coke may be 275 pounds, and the last two charges may be 200 pounds.

RAPID MELTING.

The smaller the amount of fuel used and keep the iron hot, the faster will be the melting, for if there be more fuel than is necessary to melt the iron, it must burn away before the next iron can get down to the melting point. If it is found that it is necessary to stop up often, it may be well to try and take 10 pounds of coke from each charge. If that hastens melting and the iron is still hot enough, after a few days, take off another 10 pounds, but go very cautiously with any change. The general practice is exactly the opposite. Whatever happens, the melter will add more coke, and thus make the melting

still slower. Breaking the iron in pieces of about 25 pounds, causes the iron to melt faster, and uniform charging, so as not to allow the blast to work through faster at one point than at the other, is very important.

SLAGGING.

If the heats are less than 16 tons, and especially if the sprues are milled, the slag that will accumulate will be needed to properly protect from the blast, the drops of iron as they pass down to the hearth. If the sprues are charged with the sand on, or if the heats are over 20 tons, a slag hole must be provided a little below the tuyeres, and after about 15 tons have been taken out the slag should be tapped.

FLUXES.

To make the slag fluid enough to run out of the slag hole, limestone or fluor-spar must be added. The latter is expensive, and to say the least gives no better results than limestone. Our experience has led us to consider limestone the best, irrespective of cost. About 40 pounds to the ton of iron is sufficient. It should be broken a little smaller than an egg. The limestone should be taken from the outcrop or surface of the quarry, and will be white and brittle. That farther down is hard and dark colored and makes a thick, black slag. When large heats are made, and the cupolas are slagged, it is quite customary to charge sprues with the sand on them. It is a question whether it is cheaper to melt the sand off or to mill the sprues. In large foundries, making from 25 to 30 tons of sprues, it is quite a serious matter to mill them, and necessitates two extra handlings. It is then probably better to add lime and flux away the sand.

DULL IRON.

In charging a cupola it is usual to add a few hundred pounds more iron than the molders call for. It is not well to run too close, as when the blast gets through the last charge the iron is likely to be dull. If unfortunately the iron runs short, scrap plate must be thrown in at the last end without fuel, and is almost sure to come out dull. If dull iron should occur in the middle of the heat, add a little more fuel to the charge that runs dull next day, though such dull iron generally results from a mistake in charging. It must result from a mistake in weighing the fuel or the iron, or from the iron hanging up, and later on, falling down below the melting point.

Inferior coke may cause dull iron, but this is very unusual cause, though the fuel invariably gets the blame.

QUALITY OF THE IRON.

It is generally supposed that the best iron comes down at the first part of the heat, but the reverse is true. As the cupola gets hotter the quality of the iron improves, and any special work, such as patterns, should be poured near the last end, or when about two-thirds through. If a little white iron comes out at first, charge a hundred or two of silvery iron on the bed next day, which will correct the evil. By regulating the mixture properly, the first and last ladle are practically as good as any other ladle of iron for any work.

37-INCH BORING AND TURNING MILL.

The illustrations herewith give views of the Niles Tool Works Co.'s regular 37-inch boring and turning mill, and of the same tool with special modifications. Fig. 1 shows the mill with two standard heads, this construction ensuring strength and rigidity. The bed, housings and top brace are one solid casting. The bed of the mill is partly surrounded by the column, light being admitted from the rear through the large, oblong aperture.

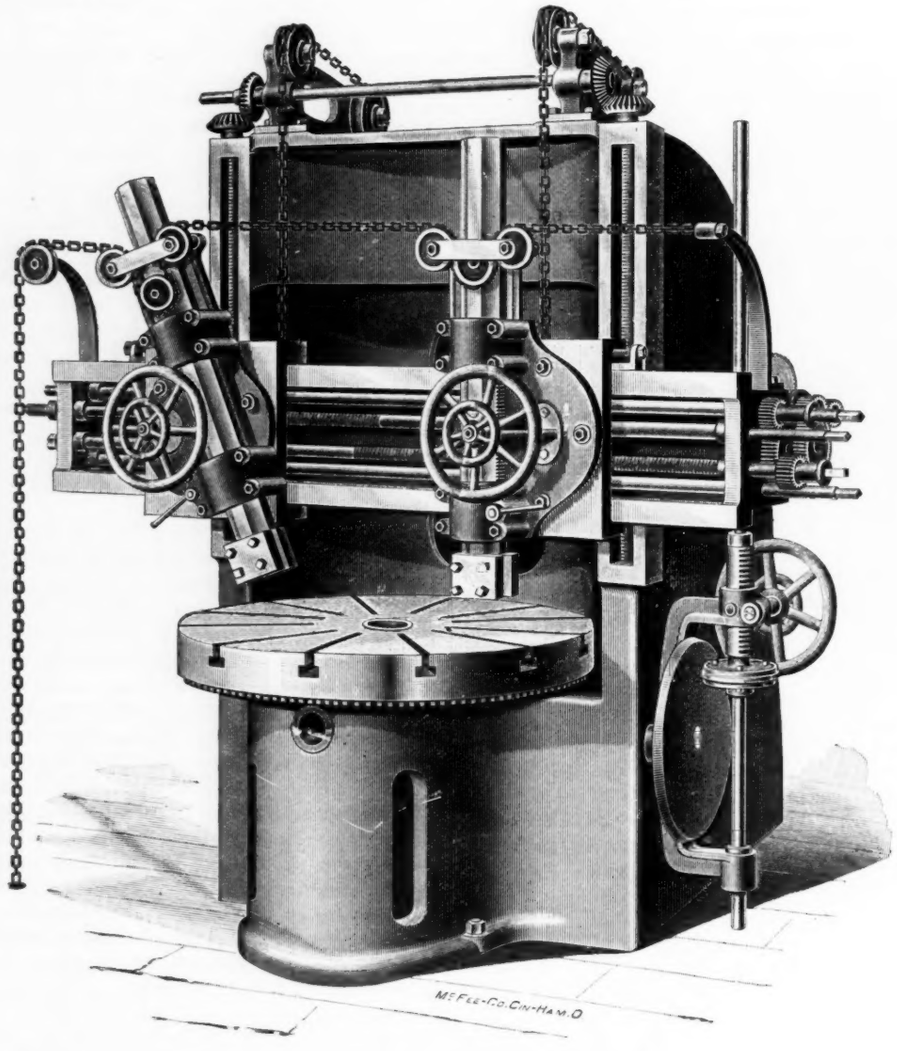


FIG. 1.—37-INCH BORING AND TURNING MILL.

The cross-rail is of box girder form, with wide bearings, being raised and lowered by power. The saddles are made right and left, permitting the boring bars to work close together.

The boring-bars are of octagonal section, as are those on the other types of the Niles boring and turning mills, and they may be set over to operate at any angle. The counterbalance for both is by the use of a single weight, arranged to render the weight absolutely inert for angular work, no matter in what position one or both may be placed. The traverse of the boring-bars is 18 inches.

The driving cone is placed at the back of the mill, has four steps for four-inch belt, and transmits motion to the table through accurately cut bevel gearing. It is strongly back-geared, and, by two countershaft speeds, gives 16 changes of speed to the table.

The feeds are operated by a friction disc, ranging from zero to $\frac{5}{16}''$. They are independent, and the saddle or bars may be fed in the same or opposite directions at the same time. The feeds may be instantly reversed without shifting the friction disc by means of simple mechanism for that purpose.

Fig. 2 shows the 37-inch boring and turning mill, with one standard head with thread chasing attachment and one special turrethead. This is the same construction as the regular 37-inch mill, with the addition of the thread-chasing attachment to the regular head, and special turret-head, the chasing attachment being arranged for four, five, six and eight threads to the inch—or others, if desired—and the turret head made for the reception of four tools.

The machine, as arranged with the above described attachment and special turret head, covers a very wide range, almost

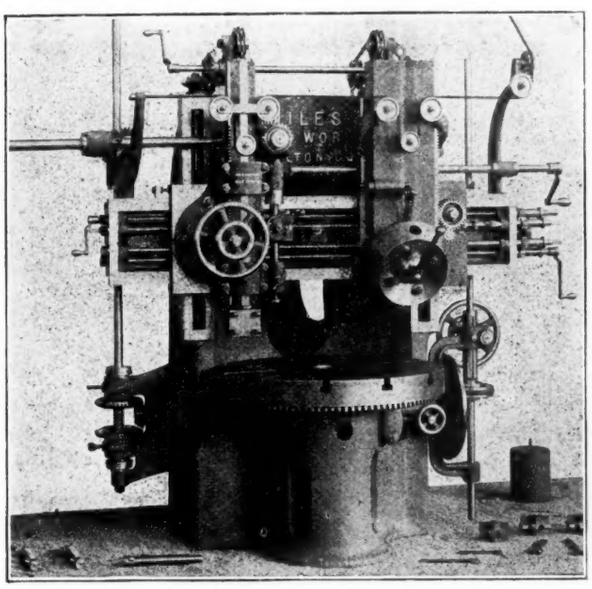


FIG. 2—37-INCH BORING AND TURNING MILL.

without parallel on small work that comes up in the ordinary machine shop and in engine works. The fact that the several operations necessary to complete the product can be performed without taking the piece from the mill, make it specially serviceable. The Niles Tool Works are at Hamilton, O.

AS TO THE SIZE OF TEST BARS.

Mr. E. H. Mumford, of the Elizabethport, N. J., foundry of Henry R. Worthington, writing in the *American Machinist*, supports the small sizes of test bars used by Mr. W. J. Keep in his "Test," against the criticisms recently made by Mr. Henning. Mr. Mumford emphasizes the fact that the smaller bars are more influenced by changes in characteristics in the iron than are larger ones, and adds: "Mr. Keep is right. If Mr. Henning had a machine shop running piece-work with tools speeded 30 to 40 feet per minute on cast iron, and he was getting castings from an outside foundry and wished to make an inspection of these castings at the foundry to determine as to their hardness, would he examine first the fracture of a large section? No, he would break off a 'fin' somewhere, and expect that any tendency to form a hard 'skin' or hard spots would be indicated by the degree of whiteness found there. Again, if a small bar shrinks 0.15″ in 12″, and a larger or more massive bar only 0.1″ in 12″, I ask Mr. Henning to admit that for every unit tendency to shrink more or less the smaller bar will give the greater indication. The same circumstance that induces greater shrinkage and greater chill in the smaller specimen also induces greater resistance per unit of cross-section to traverse or other fracture, and therefore, again, variations in structure of this cross-section due to different mixtures will have the greater effect on the smaller bar.

"The circumstance referred to is simply that the smaller bar, in cooling the more rapidly, develops less carbon in the graphic form, and is, therefore, whiter, harder, stronger, more dense and will shrink more than the larger bar. Moreover, idiosyncrasies of crystallization develop most in the bars the quickest cooled. The happening that Mr. Keep is in the stove business does not affect the immense value of his tests to the man engaged in general foundry work."

BENEFITS OF FOUNDRYMEN'S ORGANIZATIONS.

In commenting on a recent discussion by the Foundrymen's Association of Philadelphia, the *Age of Steel* says: "These quotations from the discussions and programme of the Philadelphia meeting are sufficient to indicate the tone, spirit and purpose of that educational and self-protective association, and its duplication in other parts of the country is obviously a desideratum. We are glad to note that an effort in this direction has been made in the proposed organization of a Western foundrymen's association. For a long time there has been a desire for an organization that should improve the status of the foundry interests on the broad ground covered by the Foundrymen's Association of Philadelphia. That such associations will multiply we have no doubt, their usefulness and permanence depending not only on the objects for which they are framed, but on the good sense and honest methods employed in their management."

Personal.

Mr. Andrew Carnegie sailed on the Paris for Southampton on Saturday.

Mr. Richard A. Parker, consulting engineer, Marquette, Mich., has established a branch office at 100 West Washington street, Chicago.

Mr. S. H. Holley, who was made a member of the Executive Committee of the Western Foundrymen's Association, at the recent Chicago meeting, has had an experience that peculiarly fits him for the position he occupies as manager of the Lake Shore Iron Works, since a large part of its work is for mining companies. Mr. Holley was for several years connected with mining operations in Western States and in New South Wales, and for two years was Australian representative of a large mining machinery company of Chicago.

Chief F. J. V. Skiff, of the Department of Mines, World's Fair, recently received from his associates a solid gold shield badge. The shield is suspended from a bar of solid gold, on which is engraved the word "Mines." Above the bar are a crossed pick and hammer. The staff will wear silver badges of the same pattern.

Col. J. M. Coleman, the well known Mahoning Valley iron manufacturer, president of the Coleman Shields Co., of Niles, O., is rapidly improving in health and is expected shortly to return from New York.

THE Tonkin Boiler & Engine Works Co., of Oswego, N. Y., has equipped its boiler shop with the following tools: Hydraulic riveters, 10′ 1″ gap; hydraulic punches, 48″ gap; hydraulic shears, cranes and lifts for riveters, accumulators, flanging machine press. This last has 400 tons capacity and will take in a plate of 102″ diameter. These tools will be worked under 1,500 pounds pressure. Besides the hydraulic jib cranes, a traveling crane will be put in. When the machine shop is fitted up, the company expects to have the best heavy tools for large work. Their planers and rolls are made by the Niles Tools Works, of Hamilton, O.; their hydraulic pumps by Henry R. Worthington, their engine by the Kingsford Foundry & Machine Works, of Oswego, N. Y. The company have 20 acres of ground, taking in the lake front. The shops are high and dry and a particularly pleasant place for men to work. It is the expectation that considerable special work will be done.

PNEUMATIC WATCHMAN CHECK.

A reliable watchman is without doubt the most efficient protection against damage by fire, but watchmen are not always entirely reliable; and custom sometimes begets "a habit of easiness." This, being the general experience of employers, has led to the introduction of many devices for the purpose of watching watchmen. In order that a watchman check may be of any value whatever it must be of such construction that it is absolutely impossible for the watchman to evade it without detection. The mechanical checks that are operated by keys placed at the points which it is desired that the watchman visit, and which are operated by inserting these keys into a recorder that the watchman carries with him, each key making a different record, are very easily cheated by watchmen providing themselves with duplicate keys, and without visiting a single station he can, of course, make a complete record on the paper dial in the recorder.

In view of the ease with which some of the checks now on the market may be circumvented, the Pneumatic Watchman Check Co., of Columbus, O., conceived the idea of operating a watchman check by air. Fig. 1 of the two accompanying illustrations shows the recorder with a section of it removed so that the internal arrangement of the device is made plain. A is the dial holder; B the guide arm for dial; C the puncturing needles; D the clock movement; E, deck; F, diaphragms, or air chambers; G, base and diaphragm holder; H tubes leading to stations. The paper dial is placed on the hour post of an eight-day duplex movement, brass clock works, and is held in place by dial holder.

There is a slot in the guide arm through which the paper dial also moves, and which holds the dial in place while being punctured by the needles, which are attached to the diaphragms, or thin-faced metal air chambers, made of spring sheet german silver two-thousandths of an inch thick. The small circular corrugations in the metal permit these air chambers to expand slightly when pressure is transmitted into them through the connecting lead tubes, extending from the diaphragms to the different stations throughout the building. This pressure is obtained by inserting a split key into the cast iron station and pushing it lightly, which forces the air from the end of the tubing connecting with the station clear along through the lead tubing until the air pressure reaches the german silver diaphragm, inflating it, causing a needle attached to the diaphragm to operate upward, thus puncturing the paper dial in the circle, which is numbered the same as the station is numbered; and with the hours of the day marked on the paper dial by radial lines, it may be determined at once at what time the record from any particular station was made. Each station has a separate line of tubing extending from it to the recorder, and a separate diaphragm and needle, having the same number as the station is numbered. The diaphragms have a very small hole in them, hardly discernible to the naked eye, to equalize the air pressure on account of expansion or contraction by changes of temperature. This also renders it impossible to hold the needle in the paper dial a sufficient length of time to destroy the dial by its turning while the needle remains in the paper, which is sometimes done by malicious watchmen who then claim that the machine is out of order.

The small hole allows the air to escape, and the needle then drops back to its normal position, it being impossible to hold it through the paper dial longer than from five to eight seconds.

Fig. 2 shows a station in operation. The lead tubing as it extends from the station to the recorder is thoroughly protected from damage, by stamped steel moulding. Any number of stations up to and including 50, are made to record on a single dial. A small one-station check is made that is largely used by private patrol companies for residences, banks and store rooms where merchant police only are employed.

A square-shaped recorder is also made, highly polished and particularly ornamental.

Some of the points of advantage claimed for the pneumatic watchman check are: It is so simple that it is almost impossible to get out of order. There are no batteries, insulated wires or complicated mechanisms. There is no expense keeping it up. Any mechanic can place it in position for operation. All parts are interchangeable and may be replaced without the assistance of an expert, should unavoidable accident render this necessary.

This check is now being placed on the market by the Pneumatic Watchman Check Co., of Columbus, O., and doubtless will have a large sale wherever watchmen are employed. It is fully protected by letters patent in America and Great Britain. Any further information will be furnished by the manufacturers.

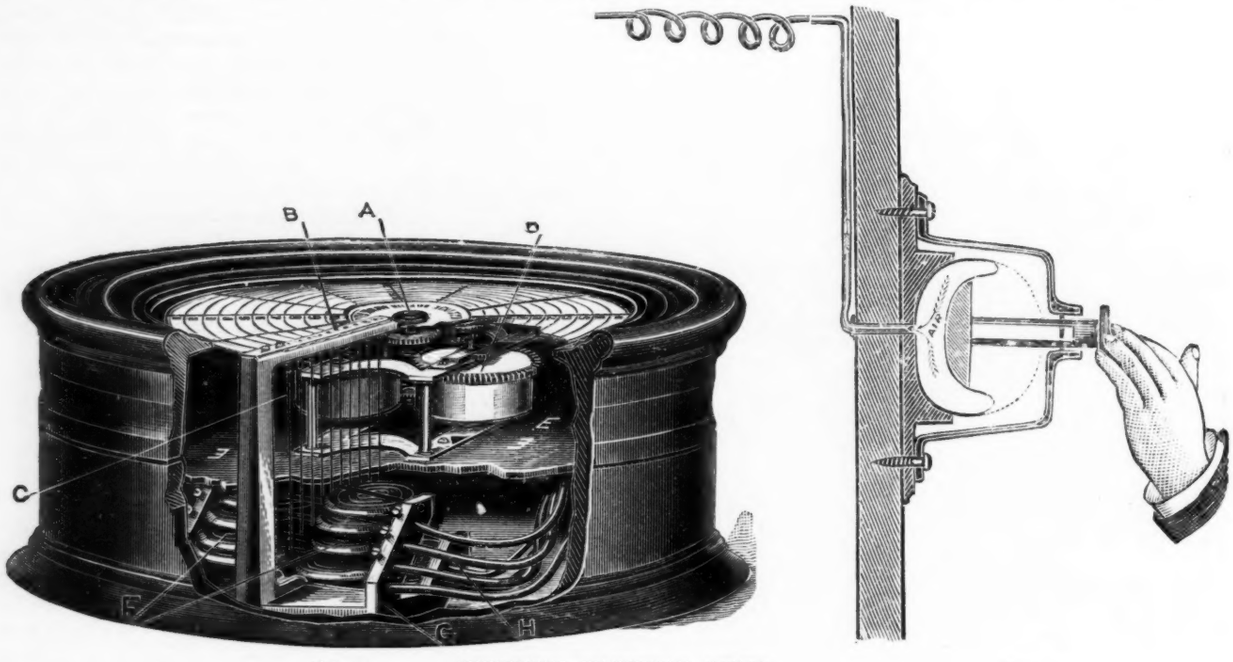


FIG. 1. PNEUMATIC WATCHMAN CHECK. FIG. 2.

AT the Redington proving grounds, near Bethlehem, Pa., the Naval Ordnance Board accepted 472 tons of Bethlehem Iron Co. armor after successful ballistic tests, on May 31. There were present Grand Duke Alexander, Admiral Kaznakoff, and other Russian and Austrian naval officers now visiting this country. The target was a 12-inch curved nickel steel one 16½ feet long and six feet high. The third shot was fired with 110 pounds of powder, which produced the terrific velocity of 2,000 feet a second. The projectile was smashed, and fell into bits at the foot of the target. The plate was penetrated a little over 12 inches, but the experts were unable to decide whether the projectile had penetrated the backing. It will be dissected, and if no pieces of projectile are found, a premium will be awarded to the Bethlehem Iron Co.

HAINES MICROMETER GAUGE.

The Haines automatic micrometer gauge, made by the Haines Gauge Co., 906 Filbert street, Philadelphia, Pa., is a tool which puts in the hands of the rolling mill man the means for measuring hot metal with nearly the same accuracy as the common micrometer gives to the workman at the bench. It is especially designed for measuring hot plates, sheets or bars while in the process of rolling. It enables the roller to finish the work to thickness desired; it is also well adapted for cold rolling. Its general construction is shown in the accompanying cut, which is two-fifths the full size. Referring to the figure it will be seen that the gauge has a long, light handle, and a throat of sufficient depth to take the measurement inside the extreme edge of a plate, and is arranged to be operated by one hand, except when it is necessary to open it for the first measurement. In applying the gauge for measurement, the gauge screw is opened by turning the dial somewhat more than the thickness of the piece to be measured; then the gauge is applied and the trigger pulled; this releases the main spring which instantly presses the screw down upon the work and sets the dial to show the exact thickness. Releasing the trigger will then lock the dial, which should be quickly removed and read. In rolling at each successive pass, the gauge will slip upon the work without resetting. In this way the amount of reduction at each pass is seen, and the exact amount of reduction necessary for finishing is known.

The dials are made for fraction and decimal measurements, and dials for any desired measurement or gauge can be provided. One complete revolution of the gauge equals one-quarter of an inch; as there are one hundred teeth, each tooth gives one one-hundredth of one-quarter, or .0025 inch. Adjustment can be made for shrinkage by a compensating screw in the lower jaw, and the gauge can be tested instantly, and quickly adjusted by using the different adjusting and clamping screws.

HAINES MICROMETER GAUGE.

These gauges are made in four different classes and in three numbers, covering all thicknesses from half an inch down to nothing. They are also made for work having an upset edge and for cold rolling, and for fine work special tools are provided, so that every class of work can be measured. With such appliances the difficulties of rolling to any given decimal are reduced to a minimum.

The Haines gauge is regarded by those who have it in use to be a valuable innovation upon the old method of calipering hot work, while reducing at the rolls. The roller or gauger, by following the plate down on the last three or four passes will know the exact amount of reduction required for the finishing pass. With the gauges opening more than one-half inch, U. S. standard gauge blocks are furnished to place between the points of the gauging screws when setting them.

ON the double track recently put down by the C., M. & St. P. between Chicago & Milwaukee, the rails average 92 pounds a yard. The management say that 90-pound to 95-pound rails will be largely used in the future and that 85-pound rails will be the minimum on big lines. The increase in weight of rails is said to be necessary to sustain the heavy rolling stock that the roads have been introducing within the past two or three years. The officials expect to find the large locomotives and cars more economical as carriers than the old style, because the former will enable the roads to abolish many trains.

THE WORLD'S FAIR BOILER EXHIBIT.

One of the most interesting exhibits at the World's Columbian Exposition to the mechanic or engineer is the boiler plant, which is the largest ever built. In the main power plant 52 boilers generate steam for 83 engines. These boilers have a rated horse-power of 20,500, but they are capable of developing much greater power than this. They evaporate about 750,000 pounds of water per hour, and about 50,000 pounds of oil is consumed in the furnaces every hour in doing this. The boilers are all of the water tube type. They are furnished by eight exhibitors, beginning at the east end of the boiler house, as follows: Abendroth & Root, four boilers, 1,500 h. p.; Gill Water Tube Boiler Co., four boilers, 1,500 h. p.; Heine Safety Boiler Co., eight boilers, 3,000 h. p.; National Water Tube Boiler Co., four boilers, 1,500 h. p.; Campbell & Zell, nine boilers, 3,750 h. p.; Babcock & Wilcox, ten boilers, 3,000 h. p.; Stirling Co., four boilers, 1,800 h. p. In the annex are four Heine boilers, 1,500 h. p.; three Climax boilers, 2,000 h. p., and two Stirling boilers of 900 h. p. All the boilers are of the horizontal type, except the Climax, which are vertical. The largest one in the plant is a Climax with 1,000 horse-power.

The Abendroth & Root boilers have 126 tubes 4″ in diameter by 18′ in length, arranged in courses 14 wide by 9 high. They have 7 drums 14″ x 20′ and one header 30″ x 12′. The Gill boilers have 360 tubes 4″ x 18′, three steam drums 42″ x 21′. The National boilers have 180 tubes 4″ x 18′, and three steam drums, 36″ x 20′. The Campbell & Zell boilers have 236 tubes 4″ x 18′, three water drums 30″ x 19′, and one steam drum 52″ x 12′. The Babcock & Wilcox boilers have 126 tubes 4″ x 18′, arranged in courses 14 wide and 9 high, a mud drum 12″ x 8′6″ and two steam drums 36″ x 18′. The Climax 500-horse-power boilers have a main shell 42″ in diameter by 29′ high, ¾ of an inch thick, with vertical seams welded. Each has 475 tubes 3″ x 11′6″.

The Climax 1,000 h. p. boiler has a main shell 78″ thick, 56″ in diameter and 35′3″ high. It has 864 tubes 3″ x 12′6″, and has an actual h. p. of 1,800. The boilers, with the exception of one Campbell & Zell and the three Climax, are arranged in batteries of two. Each pair of boilers feeds steam into one common pipe which delivers into the 36″ steam headers under the gallery floor. Of these headers there are seven; five in the main boiler room and two in the annex, the longest being 150′ in length. The headers are connected by pipes 10″ in diameter, except that between the main boiler plant and the annex, which is 12″ in diameter. These connecting pipes are arranged with elbows and nipples to allow for expansion, which is considerable in so large a plant. The main headers are securely fastened in the center to large masonry foundations, and are further supported every few feet by rollers placed on foundations. These rollers permit the headers to expand freely in each direction.

A four-inch drain pipe runs the whole length of the boiler plant, and discharges into a large tank outside. The headers are connected with three two-inch drain pipes so that in case of emergency they can be quickly emptied. The water of condensation is carried back into the boilers by Westinghouse loops. These are simply pipes carried from the bottom of the header some distance above the top of the boilers, thence to the rear of the house down the water line, and then into the boiler by an ordinary check valve.

The boilers are fed by pumps and injectors of various makes, all being listed as exhibits. The Abendroth & Root boilers are fed by six Watson injectors and two Deane pumps 7½ x 4½ x 10 inches. The Gill boilers are fed by two Korting injectors and two Barr pumps, one 10 x 6 x 12 and one 10 x 6 x 10. The pumps are regulated by a Thomas automatic feed water regulator.

The Heine boilers are supplied by eight Penberthy injectors, two Knowles pumps 10 x 5 x 12 and two Blake pumps, 8 x 5 x 12. The National boilers are fed by four Hayden & Derby injectors and two Davidson compound pumps, 12 and 20 x 10½ x 20. The Zell boilers are fed by six Nathan injectors, one Cameron pump, one Laidlaw & Dunn 7½ x 4½ x 10, one Wilson & Snyder 14 x 8 x 18, one Canton, one Worthington and one Boyts-Porter pump. The Backcock & Wilcox boilers are fed by Hancock ispirators and three Snow pumps; one is compound and 12 x 7 x 12, the others 10 x 5 x 10 and 8 x 5 x 10 respectively. The Stirling boilers are fed by two Buffalo pumps 10 x 6 x 10 and 7½ x 5 x 8 and one Gould pump and Schaefer & Budenberg injectors.

In the annex, two Marsh pumps supply the Heine boilers, the Climax boilers are fed by one Blakeslee and one Sundley, and the Stirling boilers by one Hall and one McGowan pump. On every make of boiler is a feed header into which the pumps of those boilers deliver. From this header separate pipes are run into each boiler.

Oil is the fuel used. It is atomized by a steam jet as it is discharged from the burner into the furnace. The various makes of oil burners are displayed as follows: Under the Abendroth & Root boilers, 12 Reid burners; under the National, 16, and under the Campbell & Zell, 46. There are 30 Larkin burners under the Babcock and Climax. Under the Gill boilers are 16 Arms burners. The Heine boilers are furnished with 17 Graves, 16 Burton, eight Wright and 12 Reid burners. The Stirling boilers use eight Burton and eight Locomotive burners. The oil is fed from an oil vat half a mile from the boiler house. Two mains run from this vat into a 5-inch header which runs the entire length of the boiler house. This header is tapped in such a way to supply every make of boilers with a separate pipe. The pressure under which the oil is served to the boilers is six pounds to the square inch. Running along the tops of the boilers is a 2½-inch steam pipe, with valves between each of the boilers which is fed by a 2-inch steam pipe from each boiler, and from which a 2½-inch pipe carries steam into the oil burners for atomizing the oil. The safety valves, which are the ordinary pop valves, are set at 125 pounds. There are 108 valves of all kinds on the headers alone, a grand total of 1,200 in round numbers in the boiler house.

An elaborate record is kept in the boiler house showing when each boiler is started up, when shut down, when valves are opened and closed, the steam pressure, furnaces that smoke, repairs made and other data.

World's Fair Excursions to Chicago via Best Route—The Pennsylvania Lines.

Commencing April 25th, World's Fair excursion tickets to Chicago will be sold from all ticket stations on the Pennsylvania Lines. Consistent reductions in fare will be made, and sale of tickets will continue daily until Oct. 30th, inclusive. Return coupons will be valid until Nov. 5th. Any Pennsylvania Line ticket agent will furnish details upon application.

An editorial in the June *Century* on "The Disappearance of the Apprentice System" will be read with interest by manufacturers. The article says that the master mechanic, instead of presiding over a small shop and being a master of all branches of his trade, has become, in many instances, the master of merely a single branch of his trade. He does not work with his men and can give no personal attention to an apprentice. "It has come about, therefore, that boys are hired to do the menial work of the shops, to sweep and clean, run upon errands; and, as part payment for their work, they are permitted to pick up only as much knowledge of the trade as the good nature of the foremen and journeymen will permit. Of system and thoroughness in the knowledge thus picked up there is none. From the menial nature of the employment, self-respecting boys regard it as degrading, and consequently refuse to enter upon it."

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trade:

New York, N. Y.—Mason Electric Co.; capital, $25,000; to manufacture, buy and sell electrical goods; incorporators: Alfred Van Derwerken, Jas. H. Mason, Brooklyn, N. Y.; Frank B. Johnson, Parkville, L. I., N. Y. Address letters to Jas. H. Mason, Brooklyn, N. Y.

Philadelphia, Pa.—The Grain Scouring Machine Co.; capital, $100,000; for manufacturing improved grain hulling and scouring machines; incorporators: Geo. H. Holgate, Jno. H. Welp, Fras. B. Owen, Philadelphia, Pa. Address letters to E. B. Williams, Logan, Pa.

Chicago, Ill.—South Chicago Engineering & Contracting Co.; capital, $100,000; for general architecturing, engineering and contracting business; incorporators: Stephen Creutz, E. Barrington, Chas. J. Gummarson. Address letters to Chas. J. Gummarson, South Chicago, Ill.

Kewanee, Ill.—The Boss Mfg. Co.; capital, $50,000; for manufacturing machinery, agricultural implements, farmers' supplies, clothing, gloves, mittens and notions; incorporators: Hiram T. Lay, Wm. H. Lyman, Henry T. Terry, C. C. Wilson. Address letters to C. C. Wilson, Kewanee, Ill.

East St. Louis, Ill.—The Missouri Gas Cooking, Heating & Lighting Co.; capital, $10,000; to manufacture and sell gas cooking, heating and lighting apparatus; incorporators: F. Loehr, Ephraim Stamms, Samuel McKinley. Address letters to H. A. Clover, 3rd and Pine streets, St. Louis, Mo.

Au Sable Forks, N. Y.—J. & J. Rogers Co.; capital $300,000; re-incorporation by purchase of J. & J. Rogers Iron Co.; incorporators: Hiram W. Stetson, Black Brook, N. Y.; Mabel C. Rogers, Glens Falls, N. Y.; Jas. Rogers, Au Sable Forks, N. Y. Address letters to Jas. Rogers, Au Sable Forks, N. Y.

Cleveland, O.—The Cleveland Surgical & Electrical Instrument Co.; capital, $25,000; for manufacturing and dealing in surgical and electrical instruments, materials, etc.; incorporators: John B. McQuigg, Joel M. Monroe, Albert G. Langell, Geo. B. Riley, Jno. Colahan. Address letters to Riley & McQuigg, Cleveland, O.

Chicago, Ill.—Point Benton Mining Co.; capital, $500,000; to manufacture and sell mining implements and tools, also to operate and develop gold, silver, lead and zinc mines; incorporators: M. B. Everham, W. W. Wells, T. W. McNamara. Address letters to Jas. L. Curtis, 3543 Dearborn St., Chicago, Ill.

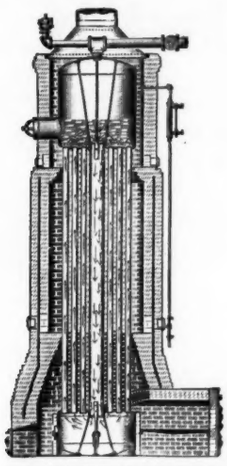
Chicago, Ill.—Mullins Blank Book & Printing Co.; capital, $250,000; to manufacture and deal in stationery, books, springs, and machinery for books, printing and publishing; incorporators: Fenton P. F. Mullin, Chas. L. Stinson, Lyman H. Abrams. Address letters to Frank W. Blair, 92 La Salle street, Chicago, Ill.

New York, N. Y.—The Conrector Heating & Ventilating Co.; capital, $20,000; for the manufacture and sale of heating apparatus; incorporators: Jas. Skilton, 115 Broadway, New York; Rufus W. Powell, 209 Skillman street, Brooklyn; Geo. S. Skilton, 372 Decatur street, Brooklyn, N. Y. Address letters to Jas. Skilton, 115 Broadway, New York, N. Y.

Chicago, Ill.—International Fruit Dealers Dispatch; capital, $500,000; to manufacture and operate cars for carrying fruits and perishable freight, commission, storage agents, shippers and contractors in freight; incorporators: J. L. McKittrick, Wm. S. Love, R. J. Campbell. Address letters to J. L. McKittrick, S. W. corner La Salle & Monroe streets, Chicago, Ill.

Chicago, Ill.—Silberhorn Refrigerator Car Co.; capital, $100,000; to manufacture and deal in cars for carrying live stock and freight, general trading, storing and commission business, warehouse, ship-owners and contractors in same; incorporators: Wm. H. Silberhorn, Jno. J. Silberhorn, Frank O. Weeks. Address letters to Campbell & Custer, The Rookery, Chicago, Ill.

New York City, N. Y.—Hartman Mfg. Co.; capital, $25,000; for the manufacture and sale of gas and electric fixtures; incorporators: Edward R. Vollmer, 30 Richmond street; Wm. Vollmer, Cor. Richmond and Etna streets, both of Brooklyn, N. Y.; Julia Hartman, 183 W. 102nd street, New York City, N.



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Cincinnati, O.—The Dameron Mfg. Co.; capital, $1,750; for manufacturing a "universal rotary cutter head and bib," "adjustable electric light shade," and a "bicycle lubricator," etc.; incorporators: Geo. W. Dameron, Wallace B. Curtis, Albert Steinmetz, Clarence Hughes, Aloysius Stenger, Anson C. Brown, Geo. M. Donnally. Address letters to Wm. Hubbell Fisher, Cincinnati, O.

New York, N. Y.—American Gas Control Co. (incorporated in W. Va.); capital, $1,000 min.; $1,000,000 max.; for manufacturing, owning, leasing and operating governors, and regulating the flow, consumption, etc., of illuminating and other gases; incorporators: Cornelius Morrison, New York, N. Y.; Gerald C. Collingwood, Glen Ridge, N. J.; J. Warren Doolittle, New York, N. Y. Address letters to Wm. A. Ohley, Charleston, W. Va.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Beaver Dam (Wis.) Implement Mfg. Co., will purchase a boiler of 85 h. p. and a 75 h. p. engine. It is expected that orders can be filled by Aug. 1.

At the office of the Supervising Architect, Washington, D. C., sealed proposals will be received until 2 P. M., June 21, for all the labor and materials required for iron furring, lathing and plastering the U. S. Postoffice, court house, etc., building, at Troy, N. Y.

Additions, Enlargements, Removals, Etc.:—

The National Brass Works, of Reading, Pa., will build two additions, each three stories high and 40x60 and 20x50 feet, respectively.

In connection with the rebuilding of the burned portions of their works the King Bridge Co., of Cleveland, will erect an entirely new riveting department, which is expected to be most complete. The fire will not prevent the filling of the company's orders.

The Ewart Mfg. Co., of Indianapolis, manufacturers of iron links, belting and chains will build an addition 200x100 feet, three stories high.

The Scranton (Pa.) Iron Fence Co. have purchased a new tract and will erect a plant commensurate with the present volume of their business.

The Pratt & Whitney Co., of Hartford, Conn., is about to put up another large factory. The new building is to be of brick, 140 feet long, 30 feet wide, and five stories high.

The Hydraulic Machine Co., of Pittsburg, are adding a foundry 106x170 feet to their plant and will equip it with a 20-ton electric crane. They have shipped recently hydraulic ingot extractors to the Cleveland Rolling Mill Co. for its new steel plant, and to the Illinois Steel Co.'s Joliet works.

Fires and Accidents:—

The old forge department of the Williamsport (Pa.) Iron & Nail Co. was totally destroyed by fire May 25. Loss $16,000. The mill will be rebuilt.

The Lima, O., mills of the American Strawboard Co. were damaged by fire to the extent of $150,000. The fire destroyed the rotary bleacher building and the engine room.

Fire in the Cornell Iron Foundry, 11th ave. and 26th st., New York, destroyed the foundry, a large iron building—but the warehouse and large sheds full of lumber were saved. The loss is $200,000. J. B. and J. M. Cornell are the owners.

At Columbus, O., fire in the Case Mfg. Co.'s yards destroyed the plant, in which mill machinery, etc., was manufactured. The J. B. Neil Mfg. Co., wheel and carriage furnishing manufacturers, lose heavily. The loss on both plants is $100,000.

General Industrial Notes:—

The Youngstown *Vindicator* announces the preparation of plans for a large addition to the Mahoning Iron Co.'s plant at

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STORES AND WAREHOUSES AT
Boston, Mass.; New York, N. Y.; Philadelphia, Pa., Cincinnati, O.; Chicago, Ill.; Kansas City, Mo.; San Francisco, Cal.; London, Eng.; Paris, France.

Youngstown. Employment will be furnished to a considerably larger number.

Owing to a strike, the furnaces of the Rock Hill Coal & Iron Co., at Rock Hill, Huntingdon county, Pa., have been shut down indefinitely.

The Thomas furnace at Niles, O., will go out of blast as soon as stock on hand is worked up, and extensive improvements will then be made.

The Lookout Iron Co.'s finishing mill at Harriman, Tenn., has resumed operations under the receiver's charge. The rest of the plant will be started up as needed.

Sixty high priced employes in the converting mill at the Edgar Thomson steel works have been displaced by machinery. They will be given work in other departments.

Suit for a preliminary injunction to restrain the Pierpoint Boiler Co., Pittsburg, from building a certain style of water-tube boilers, brought by the Stirling Co., of Chicago, which claimed infringement, has been withdrawn.

The first shipment of iron by water from Florence, Ala., was made recently, the Philadelphia furnace shipping 100 tons to St. Louis and Louisville by steamer. Low rates given by water may send a large amount of iron that way hereafter.

The Worcester Consolidated Street Railway Co., of Worcester, Mass., have placed the contract for their new car house with the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 95 feet in width and 290 feet in length, entirely of brick and iron.

The rail mill of the Bethlehem Iron Co. has shut down from lack of orders. At the old mill billets are being manufactured. The rail mill had been in operation since April 1, and before that date had been idle for three months. About 500 men are thrown out of work.

The largest girder ever made by Cofrode & Saylor, of Pottstown, has just been shipped to Philadelphia, where it will be used by the Pennsylvania Railroad Co. to span 15th street in the new Broad Street Station. It is 58 feet long and 11½ feet high, and weighs 110,000 pounds.

The P. T. Barnum estate has sued the Springfield Emery Wheel Co., of Springfield, Mass., for foreclosure of a $38,000 mortgage. Owing to differences in the management, it may be impossible to compromise the matter, and there is a chance that the company will remove from Bridgeport.

The J. H. McLain Machine Co., of Canton, O., manufacturers of steam heaters, brass fittings, agricultural implements, etc., assigned. J. H. McLain, president, made a personal assignment, as did Frank C. McLain, his son, who had a stock of bicycles, pottery, etc. The assets are $150,000, with liabilities somewhat more.

The Stove Founders' National Defense Association, which met in Chicago last week, refused the request of the molders' association, for a 15 per cent. increase of wages. The molders aver that a strike will be the result. The Association elected Geo. D. Dana, of St. Louis, president, and D. M. Thomas, of New York, secretary.

After having been in blast continuously since Oct. 7, 1891, the Salem Furnace, at Salem, Va., has closed down for repairs. The best day's run was 160 tons on March 21, 1893, and the best week's work, 1,114 tons, for the week ending March 25, 1893. The West End Furnace, between Roanoke and Salem, has also closed down for repairs.

A Baltimore special says that the advance in freight rates on pig iron from the South by the Pennsylvania, Baltimore & Ohio, and the Reading Railroads affects chiefly the furnaces in Virginia and West Virginia. The Alabama furnaces have other outlets, as have the furnaces on the lines of the Chesapeake & Ohio and Norfolk & Western.

The plans for the new Westinghouse electric plant at Brinton station have been completed. Of the 222 acres owned by the company, 23 will be set aside for the electric works. The building will be constructed of stone, brick and steel, and when finished the works at Allegheny and Newark, N. J., will be removed to Brinton.—[Pittsburg Times.

The Leechburg Foundry & Machine Co., of Pittsburg, has just received an order from the Whitaker Iron Co., of Wheeling, for a Mesta patent pickling machine for pickling plates up to 130 inches long and of any width. It has also received an order from Marshall Bros. & Co., Philadelphia, Pa., for two Mesta 36-inch trimming shears for which patent was granted April 4.

A Toledo, O., dispatch says that a receiver will be appointed for the Isaac D. Smead Heating & Ventilating Co., which has branches in all large cities; that local creditors have been attempting to reorganize but that the money stringency brought on a crisis. Another dispatch denies embarrassment, and says that in the reorganization Mr. Smead has been displaced, being squeezed out without a dollar. L. S. Baumgartner is the new president.

Poulterer & Co., Philadelphia iron merchants, have recently bought seven blast furnaces, all of which are to be torn down and none rebuilt. They are the three Ashland furnaces, at Ashland, Baltimore county, Md., abandoned since 1890; the two Maryland furnaces of H. William Ellicott & Sons, at Baltimore, and the furnaces of the late J. B. Moorhead, at Conshohocken, near Philadelphia, both of which have been out of blast for some time.

The reorganization of the West Superior (Wis.) Iron & Steel Co. means the resumption of operations within a week or ten days, it is announced. Creditors who have furnished supplies

—the Minnesota Blast Furnace Co., and the Lehigh Coal Co.—will be paid first. The plans of the reorganized company contemplate the establishment of a plant of the most complete pattern, including a blast furnace, a roll mill and such other additions and improvements that are necessary to equip the works in a first-class manner. The company will have a working capital of $500,000 when the mill is opened.

The Grant Locomotive Works, of Chicago, are being pressed by some of their creditors and a meeting of stockholders has been called to provide means. The trouble started with the strike of machinists, which prevented deliveries on contracts. The French Spring Co. and the Otis Steel Co. began attachment suits for $2,646 and $20,000 respectively. The capital stock is $1,000 000. President Fenver says, there is enough stock and material in the shops to pay all indebtedness and leave a surplus. The Grant works were built two years ago, and a land boom scheme in connection with the enterprise has not turned out well.

The inventories and appraisement of Cofrode & Saylor, of Pottstown, and of the Reading Rolling Mill Co., of Reading, Pa., both of which went into receivers' hands some time ago, have been filed. The assets of Cofrode & Saylor are valued at $726,401.94, and their liabilities at $620.357.19. The assets of the Reading Rolling Mill Co. are valued at $537,231.04, and their liabilities at $391,758.02. The receivers report that large and profitable contracts have been taken recently, and that there is reasonable expectation of a result satisfactory to stockholders and creditors. Counsel state that the Reading Rolling Mill Co. has as much work as it can do, and will probably come out of its troubles splendidly, and pay dollar for dollar

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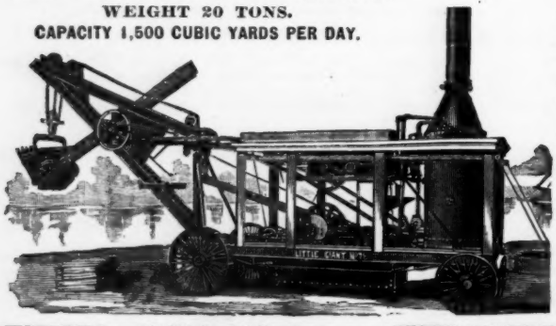

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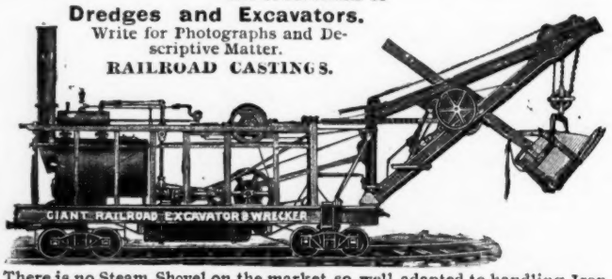

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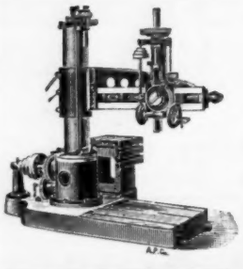

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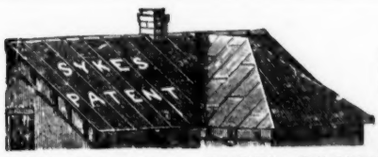

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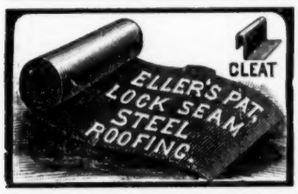

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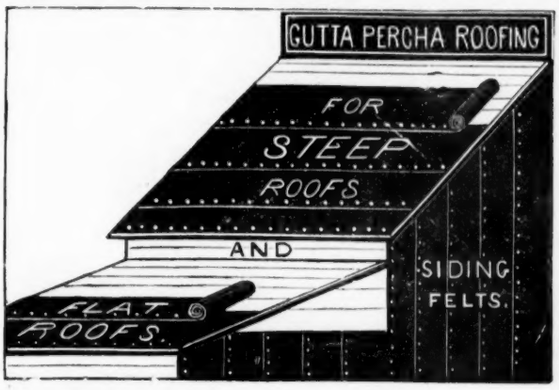

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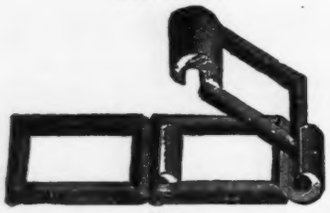

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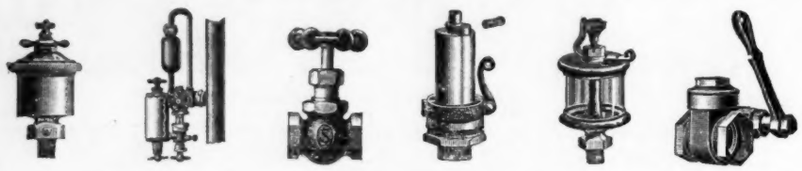

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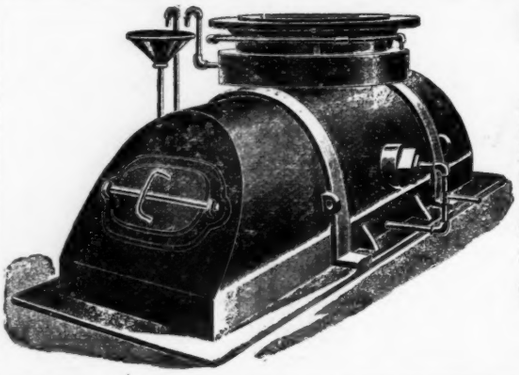

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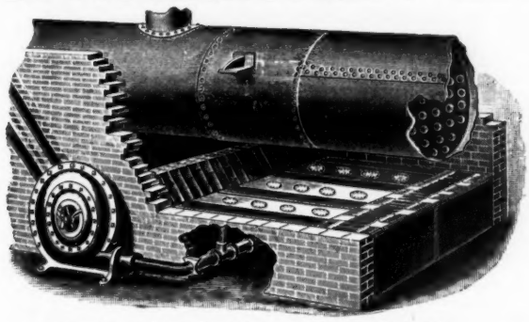

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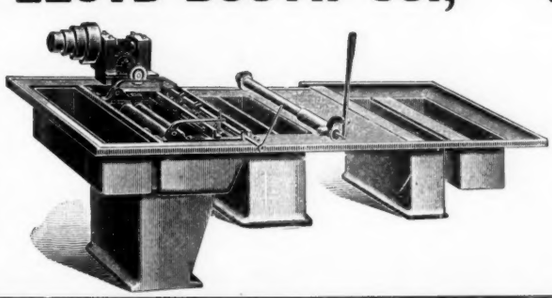

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Akron, Canton & Chicago	*8.00 A M	*6:30 P M
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Wooster		†6:30 P M
Akron, Canton & Marietta	†2:25 P M	†11:15 A M
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Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O
E. H. Jones & Co., Cleveland.
Warren Webster & Co., Philadelphia, Pa.
Brightman Stoker Co., Cleveland, O.

Hardware Specialties—
The Sam'l C. Tatum Co., Cincinnati, O.

Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

Hangers, Pulleys and Shafting—
Lane & Bodley Co., Cincinnati, O.
The Sam'l C. Tatum Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.

Heating and Ventilating Fans—
B. F. Sturtevant Co., Boston, Mass.

Hoisting Engines—
Copeland & Bacon, New York City.
Lake Shore Iron Works, Marquette, Mich.
Vulcan Iron Works Co., Toledo, O.

Hot Water Heaters—
United States Heater Co., Detroit, Mich.

House Heaters—
United States Heater Co., Detroit Mich.

Hydro-Carbon Burners—
C. D. Juvinall & Co., Upper Sandusky, O.

Injectors—
Penberthy Injector Co. Detroit, Mich.
Eagle Lubricator Co., Cleveland, O.
American Injector Co., Detroit, Mich.
James Jenks, Detroit, Mich.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Investments—
Frank R. Biedler, Baltimore, Md.
Fidelity & Deposit Co., Baltimore, Md.
Geo. Pemberton, New York.

Iron Filler—
W. W. Lawrence & Co., Pittsburgh, Pa.

Iron Ore, Bar and Pig Iron—
Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland.
E. C. Pope, Cleveland.
Cleveland Iron Mining Co., Cleveland.
Corrigan, Ives & Co., Cleveland.
B. M. Jones & Co., Boston and New York.
Wilhelm & Co., Harrisburg, Pa.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Porter Iron Roofing & Corrugating Co., Cincinnati, O.
Niles Iron & Steel Roofing Co., Niles, O.
Curtis Steel Roofing Co., Niles, O.
J. H. Eller & Co., Canton, O.
N. A. Haldeman & Co., Philadelphia, Pa.
Holton Iron Roofing Co., New Lisbon, O.

Iron Working Tools—
John Adt & Son, New Haven, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Callender & Patterson, Dayton, O.
Cleveland Twist Drill Co., Cleveland, O.
Cleveland Stamping & Tool Co., Cleveland, O.
Cincinnati Milling Machine Co, Cincinnati, O
General Engineering Co., Harvey, Ill.
Hill, Clarke & Co., Chicago, Ill.
Higley Sawing & Drilling Machine Co., New York City.
Prentiss Tool & Supply Co., Chicago, Ill.
A. P. Quint, Hartford, Conn.
Sidney Machine Co., Sidney, O.
Toledo Machine & Tool Co., Toledo, O.
Whitman & Barnes Mfg. Co., Akron, O.

Iron Ore Dryers—
The F. D. Cummer & Son Co., Cleveland, O.

Iron Nails and Steel—
Weber & Co., Cincinnati, O.
G. B. Schulte Sons Co., Cincinnati, O.

Iron Rolls and Pinions.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Iron and Steel Wire—
Trenton Iron Co., Trenton, N. J.

Lathes—
H. L. Shepard, Cincinnati, O.
Callender & Patterson, Dayton, O.
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.

Ladles—
Detroit Foundry Equipment Co., Detroit, Mich.
The S. Obermayer Co., Cincinnati, O.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.

Lanterns—
Rau Manufacturing Co., Chicago, Ill.

Lubricators—
Eagle Lubricator Co., Cleveland, O.
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Machinists' Tools and Supplies—
Cincinnati Milling Machine Co., Cincinnati, O.
Hill, Clarke & Co., Chicago, Ill.
Callender & Patterson, Dayton, O.
Prentiss Tool & Supply Co., Chicago, Ill.
H. L. Shepard, Agent Cincinnati, O.
Bickford Drill & Tool Co., Cincinnati, O.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow & Co., Beaver Falls, Pa.
Rippel & King, Canal Dover, O.

Moulding Sand—
Garden City Sand Co , Chicago, Ill.
J. Downerd & Son Co., Zanesville, O.
The S. Obermayer Co., Cincinnati, O.

Mining Machinery—
Copeland & Bacon, New York.
Lake Shore Iron Works, Marquette, Mich.
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.

Metal Sawing Machines—
Higley Sawing and Drilling Machine Co., New York City.

Municipal Bonds—
Frank R. Biedler, Baltimore, Md.

Milling Machines—
Cincinnati Milling Machine Co., Cincinnati.
Godfrey J. Bremer, Kalamazoo, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Hill, Clarke & Co., Chicago, Ill.
Prentiss Tool & Supply Co., Chicago, Ill.
Callender & Patterson, Dayton, O.

Mines and Mining Stock—
Frank R. Biedler, Baltimore, Md.

Mining Engineers—
A. Leofred, Quebec, Can.
Richard A. Parker, Marquette, Mich.

Mechanical Engineers—
J. C. Slocum, Chicago, Ill.

Office Furniture—
Cleveland Desk Co., Cleveland, O.

Oilers—
Rau Manufacturing Co., Chicago, Ill.

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C. D. Juvinall & Co., Upper Sandusky, O.

Oil Grease Cups—
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Oil Tanks—
Aultman, Taylor Mfg. Co., Mansfield, O.

Ore Crushers—
Bradley Fertilizer Co., Boston, Mass.
Totten & Hogg Iron and Steel Foundry Co., Pittsburgh, Pa.
Lake Shore Iron Works, Marquette, Mich.
Copeland & Bacon, New York City, N. Y.

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Iron Clad Paint Co., Cleveland.
W. W. Lawrence & Co., Pittsburg, Pa.
Jos. Dixon Crucible Co., Jersey City, N. J.
Empire Paint & Roofing Co., Philadelphia, Pa.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill.
Aitchison Perforated Metal Co., Chicago.

Photo-Engravers—
National Photo-Engraving Co., Cleveland.

Powder—
Hercules Powder Co., Cleveland.

Power Plants—
Weston Engine Co., Painted Post, N. Y.

Presses—
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Cleveland Stamping & Tool Co., Cleveland, O.

Planers—
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Hill, Clarke & Co., Chicago, Ill.
Callendar & Patterson, Dayton, O.
Bickford Drill & Tool Co., Cincinnati, O.

Plumbago—
The S. Obermayer Co., Cincinnati, O.

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Lane & Bodley Co., Cincinnati, O.
J. W. Foley & Co., Cincinnati, O.

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B. F. Sturtevant Co., Boston, Mass.
Foos Mfg. Co., Springfield, O.

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Totten & Hogg I. & S. Foundry Co., Pittsburg, Pa.

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Deming Co., Salem, O.
Brightman Stoker Co., Cleveland, O.
Henry R. Worthington, New York City.

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Bickford Drill & Tool Co., Cincinnati, O.

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Cleveland City Forge & Iron Co., Cleveland.

Rock Breakers—
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Bradley Fertilizer Co., Boston, Mass.
Lake Shore Iron Works, Marquette, Mich.
Copeland & Bacon, New York City, N. Y.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
General Engineering Co., Harvey, Ill.
Rippel & King, Canal Dover, O.

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Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

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Saws—
Peter Gerlach & Co., Cleveland.

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Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
Callender & Patterson, Dayton, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

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Brightman Stoker Co., Cleveland, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Ravenna Boiler Works, Ravenna, O.

Semi-Steel—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.

Steam Heaters—
United States Heater Co., Detroit, Mich.

Steel Stamps and Stencils—
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W. W. Lawrence & Co., Pittsburgh, Pa.

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F. E. Roberts Foundry Co., Chicago, Ill.

Scrap Iron & Steel—
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Toledo Machine & Tool Co., Toledo, O.
Godfrey J. Bremer, Kalamazoo, Mich.
General Engineering Co., Harvey, Ill.
Cleveland Stamping & Tool Co., Cleveland, O.

Stokers—
Brightman Stoker Co., Cleveland, O.

Steel Mushets—
B. M. Jones & Co., Boston and New York.

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The Beckett Smoke Consuming Co., Norwalk, O.
Northwestern Land & Coal Co., Boston, Mass.
Brightman Stoker Co., Cleveland, O.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.

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Cleveland Twist Drill Co., Cleveland.
The Whitman & Barnes Mfg. Co., Akron, O.

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Rau Manufacturing Co., Chicago, Ill.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Tanks—
Aultman & Taylor Mach. Co., Mansfield, O.
Ravenna Boiler Works, Ravenna, O.

Tin Plates (Roofing)—
Merchant & Co., Philadelphia, Pa.

Tinners' Hardware—
Berger Bros, Philadelphia, Pa.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tramways—
Trenton Iron Co., Trenton, N. J.

Trucks—
The Spicer Mfg. Co., New Philadelphia, O.
Detroit Foundry Equipment Co., Detroit, Mich.

Turret Drills—
A. P. Quint, Hartford, Conn.

Tumblers—
Detroit Foundry Equipment Co., Detroit, Mich.

Ventilating Fans—
E. H. Jones & Co., Cleveland.
Brightman Stoker Co., Cleveland, O.
B. F. Sturtevant Co., Boston, Mass.

Valves—
Lunkenheimer Brass Mfg. Co., Cincinnati, O.

Watchman's Time Detector.
Cleveland Electrical Mfg. Co., Cleveland, O.

Wood-Working Machinery—
J. A. Fay & Egan Co., Cincinnati, O.

Wire Machinery—
John Adt & Son, New Haven, Conn.

Washers—
Milton Mfg. Co., Milton, Pa.

Water, Gas and Steam Pipe—
Addyston Pipe & Steel Co., Cincinnati, O.
Radford Pipe & Foundry Co., Cincinnati O.

Wheelbarrows—
Akron Tool Co., Akron, O.
Kilbourne & Jacobs Mfg. Co., Columbus, O.

Wire Rope—
Trenton Iron Co., Trenton, N. J.

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Aultman, Taylor Mfg. Co., Mansfield, O.

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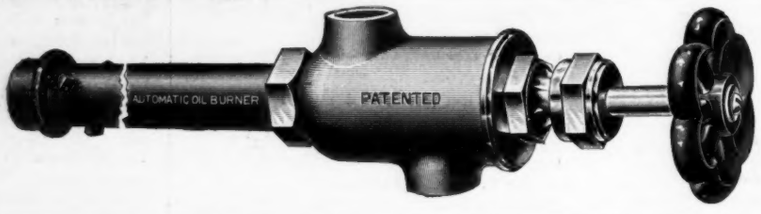

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The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
*Acme Safety Emery Wheel Co	22
Adt, John & Son	28
Aitchison, Rob't Perforated Metal Co	22
Akron Tool Co., The	31
American Injector Co	2
Andrews, Hitchcock & Co	21
Artificial Gas Engineering Co	22
Aultman Taylor Mfg. Co	17
Babcock & Wilcox Co	32
Berger Bros	25
*Berger Mfg. Co	20
Bickford Drill & Tool Co	20
Biedler, Frank R	21–29
Bradley Fertilizer Co	29
Brightman Stoker Co	19
*Brownell & Co., The	—
Bucyrus Steam Shovel & Dredge Co	20
Callender & Patterson	31
Carter & Co., James M	32
Chester Steel Casting Co	23
*Chicago, Milwaukee & St. Paul Railway Co	22
*Cincinnati Milling Machine Co	—
Cleveland & Buffalo Transit Co	31
Cleveland City Forge & Iron Co	1
*Cleveland Desk Co	31
*Cleveland Electrical M'f'g. Co	—
Cleveland Iron Mining Co	19
Cleveland Rolling Mill Co	19
Cleveland Stamping & Tool Co	22
Cleveland Twist Drill Co	32
Cole, J. Wendell	32
Comstock, L. K	32
Condit-Fuller Co	20
*Copeland & Bacon	29
Correspondence School of Mechanics	20
Corrigan, Ives & Co	20
Cummer & Son Co., The F. D	19
*Curtis Steel Roofing Co	21
Deming Co	31
Detroit Foundry Equipment Co	21
Dixon, Jos. Crucible Co	23
Downerd & Son Co., The J	31
*Eagle Lubricator Co	—
Eclipse Electrotype & Engraving Co	32
Eller & Co., J. H	21
Empire Paint & Roofing Co	21
Fay & Egan Co., J. A	27
Fleharty, J. H. & Co	30
*Foos Mfg. Co	—
Fulton Steam Boiler Works & Foundry	23
Garden City Sand Co	17
General Engineering Co	17
Gerlach, Peter & Co	25
Gilbert & Barker Mfg. Co	26
Gordon Hollow Blast Grate Co	23
Graves Elevator Co	20
Haldeman & Co., N. A	21
Harrington & King Perforating Co	30
Hartford Steam Boiler Insp. & Ins. Co	31
Hercules Powder Co	28
†Higley Sawing & Drilling Machine Co	—
Hill, Clarke Co	28
*Hodell, H. H. & Co	—
Holton Iron Roofing Co	21
Hunt & Co., Robert W	2
*Illinois Central R. R	—
Industry File Works	30
Iron Clad Paint Co	29
Jeffrey Mfg. Co	22
Jenks, James	2
Jones & Co., B. M	2
Jones, E. H. & Co	32
Juvinall & Co., C. D	26
Kilbourne & Jacobs Mfg. Co., The	2
*Lake Co., J. H. & D	—
*Lake Shore Iron Works	20
Lane & Bodley Co., The	31
Lawrence & Co., W. W	23
*Leffel Co., W. C	32
Leofred, A	1
Lloyd Booth Co	23
Lord, G. W	32
*Lunkenheimer Co., The	22
Magnolia Anti-Friction Metal Co	1
*Merchant & Co	—
Milton Mfg. Co	20
Murdock, Jr., Jas	25
National Photo-Engraving Co	27
*Niles Iron & Steel Roofing Co	—
Obermayer Co., The S	1
Oglebay, Norton & Co	19
Otto Gas Engine Co	22–30
Outhwaite, J. H. & Co	20
Parker, Richard A	20
Penberthy Injector Co	32
Pemberton, Geo	30
Pollock, Wm. B. & Co	2
Pool, F. J. & H. R	1
Pope, E. C	20
Porter Iron Roofing & Corrugating Co	21
Prentiss Tool & Supply Co	21
Quint, A. P	32
Rainey, W. J	2
Rau Manufacturing Co	28
Ravenna Boiler Works	32
Richards, M. V	19
Rippel & King	32
Roberts Foundry Co., F. E	2
Robinson & Orr	1
Sackman, F. A	30
Sargeant & Co	19
‖Sharon Fire Brick Works	1
Shepard, H. L., Agent	32
Skinner Engine Co	30
Slocum, J. C	1
Spence & Son, L	2
*Spicer Mfg. Co., The	—
Springfield Emery Wheel Co	25
Stilwell & Bierce Mfg. Co	2
Stirling Co	31
‖Stowe Fuller & Co	1
Sturtevant B. F. Co	27
Sykes Iron Roofing Co	21
Taylor & Boggis Foundry Co	1
Tod, Wm. & Co	30
Toledo Machine & Tool Co	27
Totten & Hogg Iron and Steel Co	22
*Trenton Iron Co	29
Union Electrotype Foundry	25
Union Mining Co	18
United States Heater Co	1
Upson Nut Co	30
Van Duzen Gas Engine Co	2
Vulcan Iron Works	20
*Warren Webster & Co	—
Weber Gas & Gasoline Engine Co	1
Wells Engine Co	23
Weston Engine Co	1
Whitman & Barnes Mfg. Co	18
*Wilhelm & Co	—
Worthington, Henry R	19

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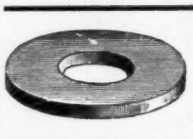

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No. 1 Specular, Bessemer	4.50@ 0.00
No. 1 Bessemer hematite	3.75@ 4.00
Hematites No. 1 non-Bessemer	3.00@ 3.65
No 1. Specular, non-Bessemer	3.50@ 4.00

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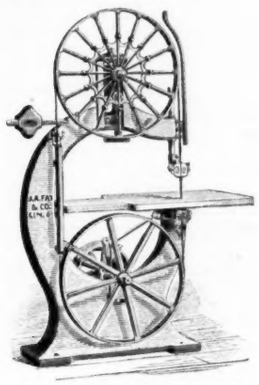
CLEVELAND (f. o. b. cars):	
Bessemer	$13 40@$13 60
No. 1 Strong Foundry	14 00@ 14 25
No. 2 Strong Foundry	13 00@ 13 25
No. 1 Grey Forge, red short	12 25@ 00 00
No. 2 Gray Forge, neutral	12 00@ 00 00
No. 1 American Scotch	14 25@ 00 00
No. 2 American Scotch	13 25@ 00 00
Lake Superior Charcoal	16 2?
PITTSBURGH (reported by A. H. Childs):	
No. 1 Foundry	$13 75@$14 00
No. 2 Foundry	12 75@ 13 00
Grey Forge	12 10@ 12 25
White and Mottled	11 50@ 11 75
Warm Blast Charcoal	18 00@ 22 00
Cold Blast Charcoal	23 00@ 27 00
Bessemer	13 50@ 13 75
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$16 50@$17 00
Local Coke Foundry No. 1	14 00@ 14 50
Local Coke Foundry No. 2	13 25@ 13 75
Local Coke Foundry No. 3	13 00@ 13 25
Local Scotch Foundry No. 1	14 00@ 15 00
Local Scotch Foundry No. 2	13 50@ 14 00
Local Scotch Foundry No. 3	13 00@ 13 50
Southern Coke No. 1	14 85@ 15 00
Southern Coke No. 2	13 20@ 13 50
Southern Coke No. 3	12 75@ 13 00
Southern No. 1 Soft	13 20@ 13 50
Southern No. 2 Soft	12 75@ 13 00
Southern Silveries No. 1	15 00
Southern Silveries No. 2	14 50
Ohio Silveries No. 1	16 50@ 17 00
Ohio Silveries No. 2	16 25@ 16 75
Ohio Strong Softeners No. 1	16 50@ 17 00
Ohio Strong Softeners No. 2	15 50@ 16 00
Tennessee Charcoal	16 50@ 17 00
Alabama Car Wheel	18 85@ 19 85
CINCINNATI (reported by Hyatt, Mathews & Co.):	
Southern Coke No. 1, Foundry	$13 25@$13 50
Southern Coke No. 2 and No. 1 Soft	11 75@ 12 25
Hanging Rock Coke, No 1	15 50@ 16 00
Hanging Rock Charcoal No. 1, Fdy	18 50@ 19 50
Tennessee Charcoal No 1	16 00@ 16 50
Jackson County Stone Coal No 1	16 00@ 16 50
Southern Coke, Grey Forge	10 75@ 11 00
" " Mottled	10 50@ 10 75
Standard Alabama Car Wheel	18 00@ 19 00
Tennessee " "	17 00@ 17 50
Lake Superior " "	17 50@ 18 00
BUFFALO (reported by Rogers, Brown & Co.)	
Mahoning and Shenango Valley, strong, No. 1 Foundry	$14 50
Mahoning and Shenango Valley, strong, No. 2 Foundry	13 50
Ohio Softener No. 1	14 50
Ohio Softener No. 2	14 00
Jackson Co. Silvery, No. 1	$17 00@ 17 30
Jackson Co. Silvery No. 2	16 30@ 16 80
Lake Superior Charcoal	16 25
Tennessee Charcoal	16 00
Southern Softener No. 1	13 65
Alabama Car Wheel	19 00
Hanging Rock Charcoal	20 50
LOUISVILLE (reported by Hall Bros. & Co.):	
Southern Coke No. 1	$13 00@$13 25
Southern Coke No. 2	12 00@ 12 25
Southern Coke No. 3	11 25@ 11 50
Southern Charcoal No. 1	15 50@ 16 00
Southern Charcoal No. 2	15 00@ 15 50
Missouri Charcoal No. 1	17 00@ 17 50
Missouri Charcoal No. 2	16 50@ 17 00
Neutral Coke	10 75@ 11 00
Mottled	10 50@ 10 75
Southern (standard brands)	17 50@ 18 50
Southern (other brands)	16 50@ 17 00
Lake Superior	18 00@ 18 50
DETROIT (reported by F. B. Stevens, 74 Griswold St.):	
Southern Coke No. 1 Foundry	$14 10@$14 35
Southern Coke No. 2 Foundry	12 85@ 13 10
Southern Coke No. 3 Foundry	12 10@ 12 35
Southern Coke No. 1 Foundry soft	12 85@ 13 10
Southern Coke No. 2 Foundry soft	12 10@ 12 35
Southern Grey Forge	11 85@ 12 10
Bessemer	15 00@ 15 25
Lake Superior Charcoal No. 1	17 00
Lake Superior Charcoal No. 2	16 00



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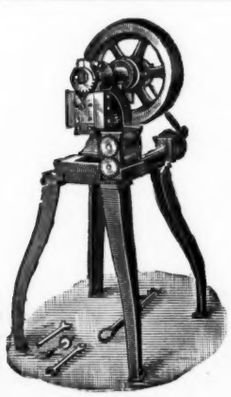

No. 25 Press.

THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

Presses, Dies and Special Machinery,

FOR BAR AND SHEET METALS. DIES FOR ALL KINDS OF WORK.

Mention this paper. SEND FOR ILLUSTRATED CIRCULARS.

Oak and Superior Sts., TOLEDO, OHIO.

LOUISVILLE (reported by Geo. H. Hull & Co.)

Southern Coke No. 1 Foundry	$12 75@$13 25
Southern Coke No. 2 Foundry	11 50@ 12 00
Southern Coke No. 3 Foundry	11 00@ 11 25
Grey Forge	10 50@ 10 75
Spathite	11 50@ 12 50
Southern Charcoal No. 1 Foundry	15 00@ 16 00
Car Wheel	17 50@ 17 75

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	Gross Tons
Old iron rails	$19 00
Old steel rails	14 00
	Net Tons
No. 1 R. R. wrought scrap	$13 50
No. 1 wrought scrap	13 00
No. 1 Machine cast scrap	10 75
Iron axles	19 50
Axle turnings	11 50
Wrought turnings (free from cast)	9 50
Cast borings	6 75
Uncut wrought iron boilers	7 00
Steel boiler Plates	10 00
Grate bars	5 50
Pipes and flues (clean)	9 00
Tank iron	9 50
Hoop and band iron	7 00
Sheet iron	7 00
Wrought drillings	7 00
Malleable iron	8 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.80c@1.90c
Angles	1.70c@1.80c
Tees	2.20c
Universal Plates	1.70c
Sheared Plates	1.80c

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 65
1¼ to 6 by ⅜ to 1 inch	1 70
1¾ to 6 by 1⅛ to 2 inch	1 85
1¼ & 1⅜ by ⅜ to ¾ inch	1 70
1 & 1⅛ by ⅜ to ¾ inch	1 75
⅝, ⅜, ⅞, by ⅜ to ⅝ inch	1 85

Round and Square.

1 to 1⅜ inch	1 65
2 to 2⅝ inch	1 75
2¾ to 3¼ inch	1 90
3⅜ to 4 inch	2 15
4¼ to 4½ inch	2 75
4¾ to 5 inch	3 00

Oval.

⅞ to 1¼ inch	1 85
⅝ to ¾ inch	1 85
½	2 05
⅜	2 25

Half Oval and Half Round.

1½ to 3 inch	2 20
⅞ to 1⅛ inch	2 00
⅝ to ¾ inch	2 25
½	2 40
⅜	3 50

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 75
1 to 1⅜ by ¼ and 5-16 inch	1 80
¾ to ⅞ by ¼ and 5-16 inch	1 90
½ to ⅝ by ¼ and 5-16 inch	2 15

Hoops.

1¼ to 4, Nos. 13 to 15	2 40
1¼ to 2, Nos. 16 to 18	2 45
1¼ to 2, No. 19	2 50
1¼ to 2, No. 20	2 50
1¼ to 2, No. 21	2 60
1¼ to 2, No. 22	2 70
15-16, 1 and 1⅛, Nos. 13 to 15	2 45
15-16, 1 and 1⅛, Nos. 16 to 18	2 50
15-16, 1 and 1⅛, Nos, 19 and 20	2 60
15-16, 1 and 1⅛, No, 21	2 70
15-16, 1 and 1⅛, No. 22	2 80
⅞, Nos. 13 to 15	2 60
⅞, Nos. 16 to 18	2 70
⅞, Nos. 19 and 20	2 80
⅞, No. 21	2 90
⅞, No. 22	3 00
13-16, Nos. 13 to 15	2 70
13-16, Nos. 16 to 18	2 80
13-16, Nos. 19 and 20	2 90
13-16 No. 21	3 00
13-16, No. 22	3 10
¾, Nos, 13 to 15	2 80
¾, Nos. 16 to 18	2 95
¾, Nos. 19 and 20	3 00
¾, No. 21	3 10
¾, No. 22	3 25
11-16, Nos. 13 to 15	3 05
11-16, Nos 16 to 18	3 10
11-16, Nos. 19 and 22	3 20
11-16, No. 21	3 30
11-16, No. 22	3 40
⅝, Nos. 13 to 15	3 10
⅝, Nos. 16 to 18	3 20
⅝, Nos. 19 and 20	3 30
⅝, No. 21	3 40
⅝, No. 22	3 50
⅝, No. 23	3 60

Crowbars.

Cast Steel	₩ lb 3½
Iron, steel points	₩ lb 3½

Brainard Milling Machine Co.

WORKS AT HYDE PARK, MASS.

Eleven Sizes of Universal MILLING MACHINES.

Six Sizes of Upright and Horizontal Plain MILLING MACHINES.

Four Sizes of GEAR-CUTTING MACHINES.

New Invention in Cam Cutting Machinery.

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WATCHMAN'S LANTERNS,
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BENZINE CANS,
PERFECTION VALVE OILERS,
TORCHES.

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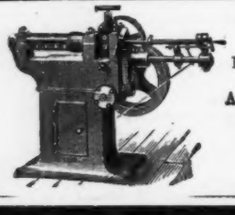

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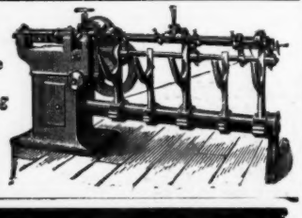
New Haven, Conn.
Builders of Machinery for Hardware Manufacture.
Automatic Wire Straightening and Cutting Machines, Butt Milling Machinery, Butt Drilling Machinery, Riveting Machines, Foot Presses, Screw Cutters, Etc.



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HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

STRONGEST and SAFEST EXPLOSIVE
Known to the Arts.
POWDER, FUSE, CAPS,
Electric Mining Goods,
AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

¾ and 11-16 by ⅛ to 3-16 inch	2 25
¾ and 11-16 by Nos. 11 and 12	2 30
⅝ and 9-16 by ⅛ to 3-16 inch	2 40
⅝ and 9-16 by Nos. 11 and 12	2 45
½ by ⅜ to 3-16 inch	2 55
½ by Nos. 11 and 12	2 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 20
⅞ inch, " " " " 13 and 14	2 30
¾ inch, " " " " 11 and 12	2 35
¾ inch, " " " " 13 and 14	2 55

Sheet Iron.

No. 10 to 14	2 30
No. 15 to 17	2 45
No. 18 to 21	2 60
No. 22 to 24	2 70
No. 25 to 26	2 80
No. 27	2 90
No. 28	3 55

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1, " "	2 50
C H Flange, " "	3 50
Extra Flange "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ℔ extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	specia

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s.
1 to 2 in, inclusive	08
9-16 to ½ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in	09
3⅛ to 4 in	09½
⅝ to 11-16 and 4½	10
⅛ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
3-16 in	13

Flats.

	cts. ℔s.
2 to 9-16 in. wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery	base price,	2 35
Tire	"	2 25
Spring	"	2 80
Sleigh Shoe	"	2 50
Toe Calk	"	2 35
Cutter Shoes, tapered and bent	"	2 75

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	4 00
Bridge ½, ⅝, 11-16 and ¾ inch diam	4 00

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 45
Munson's Short Lap Double and Light Double Leather	dis 50
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 30
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 35

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15

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Short Time Paper. **Hammock Lands.**

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WIRE ROPE
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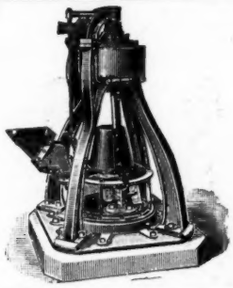
&c.



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HOISTING & WINDING ENGINES
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62 SO. CANAL ST. CHICAGO.

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CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 95
1½ to 6 by Nos. 11 and 12	2 00
1 to 1⅜ by ⅛ to 3-16 inch	2 00
1 to 1⅜ by Nos. 11 and 12	2 05
⅞ and 13-16 by ⅛ to 3-16 inch	2 15
⅞ and 13-16 by Nos. 11 and 12	2 20
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, C. F. F.
Kegs, ℔ lb	4½c	5 c	2½c
½ kegs ℔ lb	4¾c	5¼c	2¾c
¼ kegs ℔ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 55@60
Norton's	dis 55@60
Grant	dis 55@60
Sterling	dis 60
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60
Vulcanite	dis 60&10
Hamden	dis 60&10
Cyclone	dis 60

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works, Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	15c
" " " " over 5 lbs	12c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3¼	3½
Hexagon	15½	11½	8½	6	5¾	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 75
Standard Penny Nails, ℔ keg card rate	
{ Car lots	$1.60
{ Less than car lots	$1.70

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co.	dis 60
American Packing Hemp	℔ lb 9@10
Russia " "	℔ lb 14
Italian " "	℔ lb 13@19
Plumbago Piston	℔ lb 40
Peerless	℔ lb 60
Morrison's "	℔ lb 50
Square Flax "	℔ lb 50
Sheet Rubber	℔ lb 12&24
Excelsior Rubber	℔ lb 48
Rainbow { Full Rolls	50c ℔ lb
Rainbow { Less than Full Rolls	60c ℔ lb
Eclipse Gasket	℔ lb 75

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 40
Medart Pulleys	dis 50
Split Wood Pulleys	dis 50@55

Rivets.

Iron, Thousand, list November 17	dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17	dis 50&10@60
Copper	dis 50@50&10

Saws.

Disston's Circular	dis 40&10
" Band	dis 25
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Diston's	dis 30
Atkins' Circular Saws	dis 40&45
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	70c per ft
" Dexter Cross-cuts	50c "
" Diamond "	30c "
" Tuttle Tooth Cross-cuts	25c "
" One-man Cross-cuts	32c "

No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Perfection "	$15 "
Detroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Jan. 18, 1884

Brass	dis 30
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ℔ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Bolt and Nut Works.

THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

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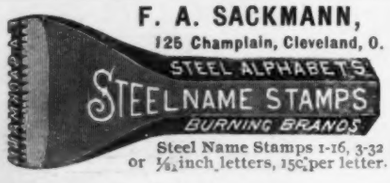

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Steel Name Stamps 1-16, 3-32 or ¼ inch letters, 15c per letter.

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GRAIN CLEANING AND MINING MACHINERY,
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STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

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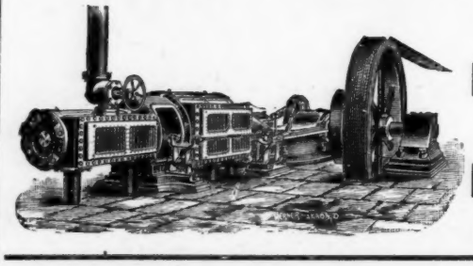
WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

THE PORTER-HAMILTON ENGINE

SINGLE, COMPOUND & CONDENSING



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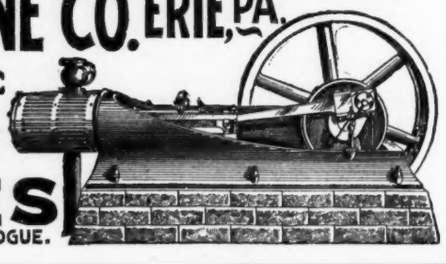
Center or Side CRANK Automatic or Throttling

ENGINES



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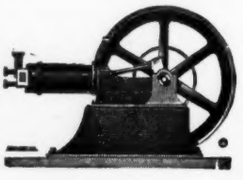
POWER From GAS OR GASOLINE.

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 100 horse-power. } **Can be Used in City or Country.**

In conjuction with our Producer Gas Apparatus, we guarantee coal consumption of 1½ pounds per hour per h.p.

OTTO GAS ENGINE WORKS., 33rd & Walnut Sts. PHILADELPHIA, PA.



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WM. B. FRANKLIN, Vice President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treas.

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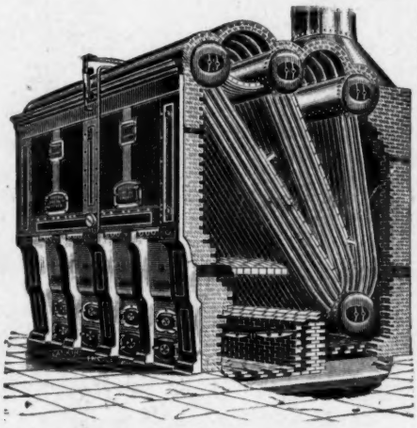
BURWELL & BRIGGS, General Agents, 208 Superior Street, Cleveland, O.

C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland O.

J. E. WOLCOTT, Special Agent, 81 4th Avenue, Pittsburgh, Pa.

THE STIRLING BOILER



Is economical in fuel and repairs, practically self cleaning. Four manholes give access to every tube. It will pay you to investigate before purchasing elsewhere. - - - - -

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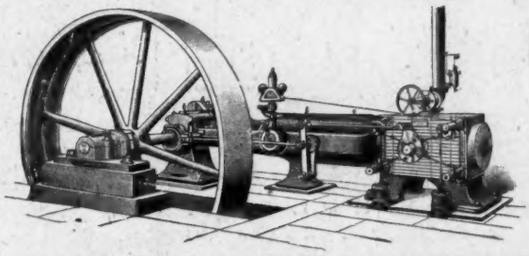

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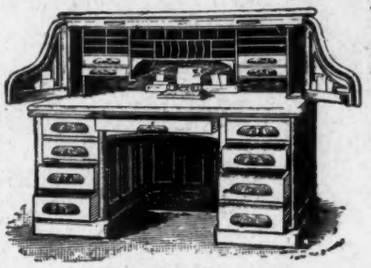

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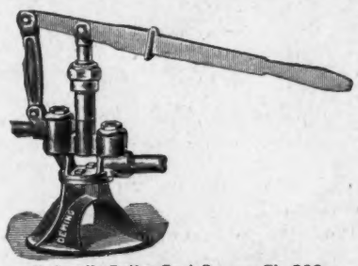

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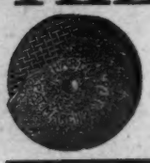

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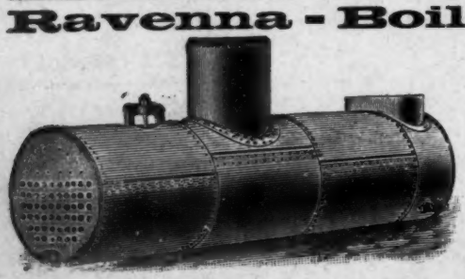

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